



Environment, Food and Rural Affairs Committee

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

Wednesday 29 January 2014

Ordered by the House of Commons to be published on 29 January 2014.

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Members present: Miss Anne McIntosh (Chair); Richard Drax, Jim Fitzpatrick, Mrs Emma Lewell-Buck, Iain McKenzie, Sheryll Murray, Neil Parish, Mr Mark Spencer, Roger Williams

Questions [59-112]

- Witness: **Professor Sir John Beddington CMG**, Special Adviser to the Oxford Martin School, University of Oxford, and former Chief Scientific Adviser to the UK Government.

Q59 Chair: Good afternoon. A very special, warm welcome to Professor Beddington for agreeing to participate in our Inquiry on Food Security this afternoon. A little bit of housekeeping: we may have to break for one vote, so we will come back as quickly as we can. Looking at your excellent Foresight Report on the ‘Future of Food and Farming’, it was very comprehensive. What would you draw as the main implications from the findings for food production systems in the UK?

Professor Beddington: Good afternoon everyone, and thank you Chair. It is slightly strange, I should say; the last few times I have been in front of Committees I have had half a dozen officials looking after me and carrying my coat and giving me briefings, and so on. I will not say I feel entirely naked, but I feel a bit different coming in front of you today.

There are some key issues that I probably should focus on, which I think are important, and they are ubiquitous really. The focus was global, but they were pointing to a few things: one was the importance of sustainability, sustainable intensification; the issue of consumption; the issue of waste; the issue of research funding; issues to do with the way that agriculture is likely to link in with climate change, in particular in terms of volatility; and thinking about ways that we could be rather cleverer about dealing with the food system as a whole. Those were the general things.

After a year we did a review—it was quite a long time ago now—of what actions had been taken, and they had been really quite pleasing. A lot of the recommendations in the report were taken up by Defra, and that work continues. The Research Councils took up quite a lot of the agenda. It is fair to say that the report has had also quite a lot of influence internationally. In the first year after we produced it we gave presentations at the World

Bank, the Food and Agriculture Organisation, and the International Food Agency, and so on.

At the moment, what I am seeing is that the sort of implicit messages that came out of that report are still rather relevant today. One of the exercises that followed on from the report was to say what the 100 key questions for agriculture are. In fact, on Monday there is a meeting in the Royal Society to ask what some of the key questions for UK agriculture are, and that discussion meeting is going to happen on Monday evening next week

The first thing to say is that, when the report came out, we had had three or four decades of declining real prices; people did not think very much about agriculture as being important. There had been a decline in investment in production agriculture over those decades. The focus had been much more on the environmental impact and issues of animal welfare, and so on, perfectly reasonably, but the report did wake up the community that this was really important. I am answering rather at length; shall I just stop there?

Chair: I am sure you will have the opportunity to comment more fully.

Professor Beddington: Okay, that is what I thought.

Q60 Chair: First of all, congratulations on both the comprehensiveness of the report and on the international recognition that it has achieved, which you must be very pleased with as the author. Without prejudicing what might be discussed at the Royal Society, just looking first of all at home, what three actions would Defra take that you think would further food security just now?

Professor Beddington: Can I put it in a global context, because I do not think—

Chair: We come on to global afterwards.

Professor Beddington: I understand that. I do not think you can isolate the United Kingdom from the rest of the world. I think the global context of food security is, if anything, more severe now than it was three years ago when the report was written. There are three things that I would point to: one is the enormous expected increase in the world population, another billion people by 2025; the second is a big increase in urbanisation worldwide. The expectation going out just 12 years is that about 60% of the world will be the urban environment.

The other thing that is really happening, which in a sense is a good thing, is increasing prosperity. A lot of people are still in poverty, but the middle classes in the world are increasingly dramatically. Just a rough figure would give you an idea that currently about 1 billion people in the developing world could be thought of as middle class; that is increasing by 100 million a year, so it will double in about 10 years. That is the context, and all of these things point to increasing demand for natural resources—water, food and energy—so that is the context we are in.

Q61 Chair: We will come on to those, but can I just ask you, locally we have seen great rafts of land under water, particularly in Somerset, and there is a call for farmland to be treated like any other property, particularly when you have got livestock that have been displaced on it and crops being ruined on it? Do you personally believe that farmland should be offered better protection from flooding and be recognised as property in its own right?

Professor Beddington: It would depend on which bits of farmland and where it is actually. I do not think there is a general answer to that. One needs to be thinking about natural equity and compensation if that was found to be the case. To go to your original question on the key things, one of the things that is really important for the UK and we are seeing it now, is enormous fluctuations in weather. Historically agriculture has been, in a sense, dependent on its history, that what had worked in the past is likely to work in the future. The issue with climate change is going to mean that we are going to see increasing volatility.

Q62 Chair: I accept that; that is the bigger picture. I am just asking you if you think that we, as a country, should recognise farmland as property. If we are losing farmland to flooding, is this impacting on food security?

Professor Beddington: I thought I had answered that, Chair, by saying that it depended which farmland and that, in any situation, there would need to be some sort of equity consideration. If it is seen as more appropriate to use some farmland in that way, I do not think one would want to be generic that you should definitely do it in all cases or you should do it in some cases. I do not think that is a sensible way to do it, but the obvious issues are to do with alternatives; for example, we have an issue in terms of productivity of the UK food industry. The trade balance is about £20 billion difference in terms of imports and exports. For the good of the country, one could be thinking about more productivity on basic land in the UK.

Q63 Chair: Just on that point, are you concerned about the levels of self-sufficiency in food production in this country? It is currently 62%; should it be higher?

Professor Beddington: It is an awkward one that, because if one has, as it were, a slightly myopic view of self-sufficiency, there have been real problems. For example, the export bans on cereals that occurred in 2010-11 contributed quite substantially but not entirely, primarily by the Ukraine and Russia, to food spikes and hardship caused by them, and similar export bans occurred on rice in previous years, so there is a problem. Currently it is something like 60% self-sufficiency, and is 60% the right answer, or is 62.3% the right answer? I think 100% is manifestly the wrong answer. There are going to be things around the margin where one can pose the question of whether one should rely on imports or try to improve on exports. To an extent, the market, the consumer and the food system itself will drive that.

I see no particular problem in a policy position saying it would be nice to increase our self-sufficiency, but it would be foolish to believe that you could increase self-sufficiency by a dramatic amount, and that would be consumer-driven, because consumers like a variety. It is unlikely we are going to grow coffee in Kent, for example.

Q64 Chair: Do you think there are any lessons that could be learned in terms of food security from the horsemeat adulteration, particularly with regard to traceability and making the supply chain more resilient?

Professor Beddington: There are some issues here that are quite complicated. One of the ones is really whether there is a food safety issue, but also a question of fraudulent practice. I do not think that there is much to learn beyond that particular thing that there are apparently fraudulent activities. In terms of food security, I do not see that there is much to be learned from that, other than the fact that we do have the ability to detect adulterated products to really rather quite detailed levels.

It is almost a joke that, if one used the level of testing, it is pretty certain you would find human DNA at some level, just because somebody had touched it. One can have a ridiculous situation where one was saying, “no DNA other than the actual specified product”, and that is just not workable. The pragmatic decision was taken at the time saying it has got to be greater than 1% before you take it seriously, and I was in Government at the time; I thought that was a very sensible and pragmatic decision.

Q65 Sheryll Murray: Professor Beddington, does the UK have a role in responding to the imbalances in supply and demand for food at a global and a regional level?

Professor Beddington: Could you perhaps expand on what you are looking for there because, although I heard the question perfectly adequately, I did not quite understand what sort of answer you were looking for?

Q66 Sheryll Murray: Basically, what should the UK’s response be to ensure its own food security in the context of future expected global changes in supply and demand?

Professor Beddington: I see, thank you. We are in the pleasant position that we can buy on the world market and many of the products are available on the world market. We are a sufficiently prosperous country that we can do it. From time to time, we will see shortages of certain products in which the price will go up as normal price mechanisms. In terms of a UK response, one would be looking—again, it is round the margin of how self-sufficient we want to be. Is it attractive, for example, that we are dependent on a couple of countries for coffee? Well, we do not have any choice, because we are not going to be able to grow it here.

In terms of the amount of wheat that we currently grow, we could grow rather more wheat, but could it be grown more cheaply elsewhere? I think the answer is yes. It might be possible with fairly high inputs to grow other products, maize, soya and so on. The question is really an economic rather than a scientific one: we could do it, but is that a particularly sensible thing to be doing? It will be round the margin. In a sense, the self-sufficiency answer that I gave to the Chair would probably be much the same as I would give here. We could do it, with some exceptions, but the question is one of economics and the market.

Q67 Sheryll Murray: What should the balance of responsibility be between Defra and DFID in addressing the imbalance at regional and global levels?

Professor Beddington: That is an interesting question. This is the sort of question I was asked when I was the chief scientist in Government and now, outside, I am allowed to answer it. There is a funny feeling of freedom, is there not? The first thing to say is that they clearly have to work together and, indeed, they do. If we think about the sort of activities that DFID is doing, and they do put a lot of money into the agricultural research system, they work together. One of the things that I could point to, which is some degree of achievement, is that the chief scientists of Defra and DFID meet regularly; they meet once a week, and that is the sensible way of co-ordinating at least the scientific work.

In terms of the overall policy, it is highly unlikely that DFID, for example, if it wanted to go in for food aid, would see to buy in the UK, because they can buy cheaper on the world markets. Learning about research, I particularly think that the area of climate change is where co-operation is important. Both Defra and DFID fund, for example, the Hadley Centre at the Met Office. Essentially the agendas are complementary, but the same research questions need to be posed.

Chair: That has sparked a lot of interest.

Q68 Iain McKenzie: When you intimated that they are certain crops that we do not grow in this country or will not grow in this country, how far ahead do we place orders for those foods? Is the order that is placed in a quantity that says, “We will pull X% amount of your production that year”? How do we place that order?

Professor Beddington: I do not know that I would seek to do it that way, if I understand the question. There is a real issue to do with how closely involved the farming community is with these sorts of policies. There are various regulations that can be brought in as policies, and there are taxes and so on, but in terms of the farming community’s response the key is going to be the market and how they would response from a market point of view. Perhaps I misunderstood your question, because you are looking puzzled.

Q69 Iain McKenzie: No, I am just wondering if we had this year a particularly bad year across the globe for certain crops, would we take that into account. Would we project ahead and place that order, if there was a reduced supply, so that we would still take a large percentage of that?

Professor Beddington: It depends on the size of the organisation. If we think about the big retailers, they will certainly be looking ahead at whether there are likely to be any shortages of a particular crop, say coffee or chocolate. They will be looking at alternative suppliers, because one of the things about the global food system is that you can look to alternative countries, so if there has been a disastrous harvest in one country you can look to another country for an alternative supply. That is pretty much what, from what I understand, the big retailers do.

If you were thinking about more common products, wheat and so on, the futures market is the way that that tends to work, and in a sense decisions will be taken both by people wanting to hedge prices, but also to buy forward. I think that is the way the market is currently working. If I may, Chair, I must say most of the questions are asking me about things to do with economics, and I was the Chief Scientific Adviser and still am a scientist, rather than an economist, I should say.

Chair: You are doing very well.

Q70 Jim Fitzpatrick: Professor, Sir John, very good to see you again and on such good form. In terms of your answer to Mr McKenzie, given that we have got some of the best brains in the country coming into Select Committees giving us answers, the surprise for me is that more of us do not look more puzzled more of the time, but that is because we have got poker faces sometimes and we do not show it.

Just something occurred to me in terms of UK food production, the ability to feed ourselves and the figure of 60-something per cent. Given climate change, and notwithstanding that farming is subsidised, given that we are operating in a free market, do you think that pattern is going to change, so that we will be exporting more in the future, because what we produce is more valuable? Do you think that we will be producing more in the future and importing less? How do you think that balance is going to change in the foreseeable?

Professor Beddington: The honest answer to that, Mr Fitzpatrick, is that I do not know. What I can say is some of the things that will affect it. The first thing to say is that probably, if we are looking in the next two or three decades, the UK is going to suffer less

ill effects from climate change than some other parts of the world. To that extent, we are fortunate. Most of the assessments that had come from analysis of climate change are saying that essentially Northern Europe and the temperate zones of the Northern Hemisphere are actually going to have relatively benign results from climate change. With warming you may see things like the wheat belt move north in Canada, Ukraine and Russia, and so on.

Here, I think that we are fairly small in a world context. We might expect to see some areas actually increase; others would be less. One of the problems, and perhaps I should expand on that now, is that we are going to see an awful lot more volatility. The point I was making to the Chair's question was that farming has tended to rely on history, and the past is not going to be anything like such a good guide in the future, because we do know that we are going to see more volatility and more extreme events, and that is going to affect agriculture.

The consequence of that, which I do think is important, is that we really are going to need better ability to forecast weather. We obviously do it in terms of issues to do with human life, or property damage due to flooding, and so on, but I think there is real scope for linking meteorological prediction more closely to the farming community. Everybody watches *Countryfile* these days or listens to *Farming Today* and you get a forecast, but it is well within the capability of our meteorologists now to predict on forecasts of a few days away very accurately, but also giving you some idea three or four weeks ahead.

For example, not this last winter but the previous winter, it was pretty much predicted we were going to have a very, very cold period at the tail end of January or, last summer, that we were going to have a fairly mild autumn. These are the sort of things that the farming community could benefit from a lot, I believe, and that is one of the things that I would be seeing as a change that will happen.

In answer to your general question, are we going to be producing more or less, it will depend a lot on the commodity. If, for example, we do see the sort of warming that is expected, I suspect we may be producing rather more horticultural products when we have previously imported them.

Q71 Sheryll Murray: Turning to your remark about another 1 billion population by 2025, will there not be a reduction in the birth rate as the emerging and developing economy income rises?

Professor Beddington: That is a very good question. From what we know about the sociology of fertility there are three factors that affect it: one is prosperity; the other is the education of women; and the third is the availability of contraception. Due to the way that the world population has changed, what we are looking at is essentially 500 million additional Africans by 2025 and 500 million additional Asians. Africa has a bigger effect, because the current population is 1 billion; the current population of Asia is about 4 billion.

Albeit that you may see declines in fertility with increasing prosperity that comes after quite a time lag, and the current rate of increase is lower than it was 10-15 years ago in most countries but, because you have much larger populations, the basic increment is much higher. I find it breathtaking if I think about putting Africa together with the

urbanisation population growth in Africa. It is saying that in 12 years' time there will be about 1,000 additional cities the size of Edinburgh.

I find that a breathtaking statistic and it will not be much affected by gradual declines in female fertility, but I do think on a timescale of 20 years or so these issues of population must be addressed. They have got to come up to the forefront because, if you do not get the decline in fertility that one hopes, you are not talking about a population of 9 or 10 billion; you are talking about a couple of billion more, and that is truly problematic for civil society.

Q72 Iain McKenzie: Do you see more farmers taking dramatic steps to protect their crops in the future from extreme weather, and against slippage in seasons as well?

Professor Beddington: The honest answer, Mr McKenzie, is I really do not know. I am not au fait with the farming community at quite that level of detail, so you would get a better or more informed answer from the NFU or farmers' organisations. What I would expect to see is that, for example, there would be more attempts to improve drainage; to be thinking about inputs that would provide protection against significant excess rain. I also think you will start to see some changes in crop varieties as people decide to invest, depending on weather, on crop varieties that are more resistant to drought, or more resistant to excessive rain.

You will see that, but it will be a relatively gradual change, except in areas like, for example, East Anglia, where you have the potential of flood surge or something, where people will have to think hard about dykes and keeping those in good repair.

Q73 Neil Parish: Good afternoon, Professor Beddington. Further to Jim Fitzpatrick's question, the Secretary of State wants to encourage consumers to buy more British food. Is there an optimum balance between imported and domestically produced food?

Professor Beddington: I do not really think so. It would depend on the product, and I do not think you can say that 60% is optimum or 62.4% is optimum? I just do not think there is an answer like that. What you can reasonably say, and you need to analyse it by product, is to ask if it is possible to encourage the growth of a consumer appetite to buy British. If we are going back to the horsemeat scandal, I think you have seen a big change there in consumer habits, as they have focused more on British-produced product. It is quite possible to see that consumer change.

I also think it is possible to be thinking about putting research into areas where you could be thinking about growing particular products more successfully in the United Kingdom environment than you have hitherto and, again, that is a perfectly sensible thing to do. One cannot attune these things to something approaching an optimum but, in a sense, if the direction of travel is that one erodes what is a trade deficit in food products of about £20 billion, then it has to be a direction of travel that is attractive to the country. How much and how far you are going to be able to achieve that with different interventions is pretty much impossible to say at present.

Q74 Neil Parish: Linked to Sheryll Murray's question is that with the increase in world population, you also made the point that there would be 100 million more every year becoming middle class. They will eat more meat. It is not very fashionable to talk about meat production, but in the end we will need more meat in the world. I know Jim will not

necessarily eat it, but there will be people eating it. Therefore, is there an argument that more meat will be absorbed across the world, so we need to increase our meat production in this country?

Professor Beddington: It is an economic situation, is it not? Most of the increase in meat consumption is primarily in Asia. Actually, there has been very little in India and that area of the world in South Asia. In fact, there are very big increases in dairy consumption there, so it is slightly different. In terms of the UK, it would be possible, but it would depend on a lot of other things. One of the problems about meat production, particularly chicken and pork at the moment, and indeed parts of the beef industry, is the cost of grain, which is being fed. It is basically an economic argument. I suppose it might be arguable that one should be thinking about intervening in farming and subsidising production of lamb or beef, and so on, but that is fairly unfashionable too.

Q75 Neil Parish: Okay, I will not press you further. As far as seasonal crops are concerned, one of the things about buying more British is that in the supermarket you will find that people want strawberries in January. They may not taste of anything, but they want them. If we are going to grow more crops out of season, which we can, but probably through greenhouses, polytunnels or whatever, what is the likely impact of that?

Professor Beddington: Taking strawberries, you have seen quite a substantial increase in home-grown product being used. At the moment it is pretty unlikely we are going to grow much in mid-December, especially the December that we have just had, or the January we have just had, even under artificial light. You have seen that increase primarily by either greenhouses or under sheltered production. I would expect that to happen in certain horticulture products; others less so. Strawberries are a good case, where you have seen quite a substantial increase in the last decade.

Q76 Neil Parish: What about the obstacles, in your opinion, to a more diversified agriculture in the UK? Is it planning? What is it?

Professor Beddington: I have not really given it any thought, I am afraid, Mr Parish. I feel agriculture is fairly diversified. It is a market-driven activity; it is choice. One of the dilemmas, for example, is whether you grow biofuels on grade A land.

Q77 Neil Parish: I think you will get a question about that in a minute. For instance, should we have more big greenhouses such as Thanet Earth, for instance?

Professor Beddington: Of course you had Professor Benton and Professor Crute with you. They are Thanet Earth fans, are they not? It is an interesting question because, in effect, that sort of production can be highly productive on not particularly good quality land. That is going to be really important. We have in the United Kingdom really quite limited amounts of very high quality land. Could we be thinking about using brownfield sites for the production of horticulture? I think the answer is, yes; it is a fairly substantial capital investment, but it could arguably pay off.

The question that we need to be pondering is, going back to questions of national food security, self-sufficiency and so on, which we have covered, do you really want to have a planning regime that allows top quality agricultural land to have alternative uses? In a sense it is a political question, not one that I would comment on.

Q78 Neil Parish: Such as solar farms and the like?

Professor Beddington: Yes, indeed.

Neil Parish: I am leading the witness.

Q79 Chair: What is the attraction of purple tomatoes?

Professor Beddington: Purple tomatoes? This is the GM variety they have been developing in—

Neil Parish: Very good quality, I imagine.

Professor Beddington: In John Innes. It is a consumer issue, is it not? With any GM product it is not a consumer issue, because it is an issue of regulation by the European Commission, driven by the European Community. Of the ones I would single out, purple tomatoes is an attractive one, but the GM technology that has been developed at Rothamsted and the John Innes Centre, two of our really top world-rated institutions, the blight-free potato that has been developed at John Innes could save an enormous amount of pesticide use. The recent thing from last year was when Rothamsted developed a wheat strain, in which they inserted a peppermint gene, which produced a pheromone that is the alarm pheromone of aphids. That has the potential for growing wheat without any infestation of aphids whatsoever, and the aphids are not even lost to the ecosystem because they just do not go there. These sorts of GM technologies are really quite exciting.

There was another one coming out of Rothamsted—a plant that could produce essentially the equivalent of fish oils, the Omega 3 plants. There was a lot of publicity about that. Again, we had the technology in our institutions. The problem we have is European regulation, both driven by political considerations and a view that, in a sense, that it is enormously difficult to get a product licence. The ability to get a GM product licence in Europe is extremely difficult, and costs vast amounts of money, so that it is very hard to imagine any organisation other than a large profitable multinational doing it. We are really losing out here.

Chair: We come on to that; I was just making a flippant remark.

Professor Beddington: We come on to that, okay. You asked me about GM product.

Chair: I just do not like the thought of purple tomatoes myself.

Q80 Richard Drax: Professor, can I come on to the increased demand for food, in particular protein? I will give you the background, if I may, before I ask the question, to help you answer it, from the interviews we had previously. A lot of the soya comes from South America for processed foods, and Professor Benton told us that 70% of foods in the supermarket contain soya. Professor Crute cautioned, and I quote, “It may be much more sustainable to produce the protein you want on land in Brazil that has already been cleared of forest than to clear more land in this country.” The increase of things like meat and dairy in China have increased fivefold per capita, again Professor Benton said, the end result of which is the challenge of importing large amounts of soya. If China wants more food, food prices are going to rise. With this expected increase in demand for protein in countries like China, parts of Africa and South East Asia, how is this going to be achieved sustainably, do you think?

Professor Beddington: There is an interesting issue here. Brazil is the obvious country to look at, because they produce a very substantial amount of soya protein, primarily for animal consumption. Most of that is now GM; there is a tiny amount of non-GM soya being produced, to the extent that it is very hard to even find it, because the GM technology for soya is enormously economically attractive. The fact that non-GM product

has some price premium is of indifference to the farmers that are actually producing it. We are going to see more GM technology in the developing world, and we import substantial amounts of GM soya now, and it is used for the meat trade.

In terms of significantly increasing the production of—let us take soya, but other protein cereals would be worth thinking about—there is lots of potential. There are very substantial amounts of land, which is moderately degraded; it is not tropical rainforest in Brazil, and one could be thinking about expanding there, and I expect people have. I think the same goes for parts of northern Argentina, which I expect to see now.

Oddly enough, I think that we will start to see production in parts of Africa of high-level protein. We have all heard of horror stories of land grabs and so on but, as there is development in Sub-Saharan Africa, we may see an increase in production of crops with a high protein content. There is no doubt there is a shortage of them.

Q81 Richard Drax: What impact is this going to have on the UK and EU food security over the next 10 to 15 years, do you think?

Professor Beddington: The issue is really of a price relationship. There is a world price for soya. The importing companies buy on the world market. If there becomes a shortage, the price will go up and it will have an impact on food inflation and general inflation in this country, as it could in the European Union. I do not think we are going to be in a situation of protein starvation; it is just a price mechanism that will harvest it, and we are a wealthy country compared with other parts of the world. We will not be in a situation where we will not be able to buy in the protein. The issue is round the margin. It is whether, in fact, pig production or chicken production is going to be profitable in the UK if you are importing grains or soya to feed at what is a very high price.

Q82 Richard Drax: What will be the principal resource limitations to increased food output given that land is limited?

Professor Beddington: The big ones are clearly water. Are you asking UK or worldwide?

Richard Drax: Yes, UK.

Professor Beddington: Ludicrously there is an issue about water. It does not feel like it at the moment but, in fact, most of the projections are indicating we might expect to have quite a dry South of England, where there will be some issues there. We have some issues to do with fertiliser, whether it is nitrogen- or phosphorus-based fertiliser, and we need to be thinking hard about that. There are going to be issues to do with the use of these fertilisers and indeed the use of pesticides, because we have a major problem of insect pests and fungi as well.

There is some real hope here in terms of the better use of engineering, and what we roughly term 'precision agriculture'. I was recently at Harper Adams University where they have got a group focusing exactly on trying to have better precision agriculture, so you use less fertiliser, you use less pesticide and you use less water. There is a real future in that at the high-tech end.

The other thing that I would point to as a potential constraint is, I suppose, the weather in general. We are an island on the edge of a large ocean and on the edge of a large continent, and we have really quite variable and very difficult to predict weather. This is

one of the reasons when I was answering Mr Fitzpatrick's question I was saying that I think we really need to be looking quite hard at better prediction in the agricultural area.

Richard Drax: Just quickly, GM food linked all those answers.

Chair: We are coming on to GM.

Richard Drax: You are? In which case, I withdraw. Thank you very much indeed.

Q83 Chair: Can I just ask, are you worried about the impact on food production of water that might be used in hydraulic fracking?

Professor Beddington: You asked my colleagues about that, did you not?

Chair: I might have done.

Professor Beddington: I think it is a public record now. Yes, I think it is not going to be a big deal actually, if you think about the amount of water that is actually used in agriculture. Fracking uses a lot and it might be a local issue, but it is not going to be an issue on a large scale.

The issues to do with water use in fracking are a concern about the pollution of aquifers. A report that I commissioned while I was in Government by the Royal Academy of Engineering and the Royal Society pointed out that, with sensible regulation of the wells, there really should be no danger, because the water aquifers are very substantially separated by about a kilometre from the reservoirs of gas and oil. To speak quite simply, unless you have got a leaky wellhead, you are not going to do it; there will not be migration between. That is pretty much a consensus of the science and engineering community. The pollution is an issue, but can be dealt with by regulation.

In terms of the amount of water that is actually needed for fracking, production of energy, whether it is via fracking or in the normal processes in power stations, does use an awful lot of water, but I can only imagine it being a local effect, rather than a country-wide one.

Q84 Chair: But you do not actually know.

Professor Beddington: I think one does not ever know anything very much, does one, if we are going to be philosophical about this? I could enquire, but there are others who would have basically done that calculation, but in fact, one way, I do not know. I would see lots of reasons why it could not be very large, because of the arithmetic really.

Q85 Neil Parish: Just going back to the import of soya, or importing chicken meat and pig meat that has been fed on GM soya, it has the potential to put our own industry out of business. The irony is that, in the end, people will be eating the exact same meat that has been fed on GM products. Is it not time we and Europe changed our minds on this? People are still eating it, irrespective of whether we use it or not.

Professor Beddington: My own views on the GM bans are that they are not evidence-based.

Chair: We are coming on to that, so we do not want to—

Neil Parish: Considering, Madam Chairman, you got on to fracking which, in my opinion, had absolutely nothing to do with this, I really think that we can actually pursue a question.

Chair: We are coming on to that.

Q86 Mrs Lewell-Buck: Professor Beddington, you will be pleased that I have got a bit of a science question for you. Earlier you said that the UK will suffer less from climate change, but obviously bearing in mind that we will be affected by it, what is it that we should be looking at in the longer-term picture to try and mitigate the future effects of it?

Professor Beddington: Do you mean just in agriculture, or do you mean more generally?

Ms Lewell-Buck: More generally, if you can.

Professor Beddington: The first thing to do is that we do need to continue to invest in the science of climate change. One of the things that is not really appreciated in our knowledge is that the weather we are getting currently is determined not by the greenhouse gases in the atmosphere now, but the greenhouse gases that were in the atmosphere in the 1990s. The climate system has a 20-25-year time delay in it, so in the 1990s greenhouse gases had accumulated, and the weather we are now seeing is coming from essentially the climate that was determined 25 years ago.

If you extrapolate that, obviously there has been an increase since the 1990s in greenhouse gases, so we know that, if we look 25 years down the track, the weather we are going to be getting is going to be determined by that increased level. It is likely to be more volatile; it is likely to be particularly volatile if we think about the UK. We would also have an expectation therefore that you would get more extreme events. The rain will be heavier; the droughts will be longer; heat waves will be more severe. There is a real consensus that this is the pattern of climate change that we should expect.

It is going to mean issues to do with infrastructure. In particular, we are going to need to be thinking about how we have flood defences. The question you were asking me earlier was about whether farmland should be used as a flood defence. I heard on the *Today* programme that the World Wildlife Fund was saying that they thought it should. It is a question of individuals, where, when, how and if it can be done by agreement. We have got to expect more extreme weather, and, in consequence, to hark back to the point I was making, if we are having more extreme weather we have to be able to know it is coming. We have to be able to know it is coming on as long a time period as we possibly can, and that means continuing research in both climate and meteorology. That is the science answer. Whether the South East of England is going to grow peaches, the answer is probably, but I would not like to give you a timescale on it here.

Q87 Roger Williams: Greenhouse gas emissions from livestock production is a very contentious issue. There seem to be two ways in which you can reduce it, either by altering the management or husbandry of the livestock, or by just reducing consumption of livestock products, whether they are dairy or meat. Should we be doing either or both, or can we do either or both?

Professor Beddington: It is a very under-researched project. In terms of thinking about diet for livestock, there has not been much research on it. There is now a worldwide programme looking at what interventions can be done for mitigating greenhouse gas emissions from livestock, and that really is a big international programme, which a number of our main research institutes and universities are involved in. There is stuff that can be done. For example, if we are talking about manipulating the flora in the rumen,

one could be thinking about doing that, which would reduce greenhouse gas emissions, when you think about diet.

There are also mechanisms whereby substantial intensification means that you can capture the greenhouse emissions as well as the other waste products. There are obviously costs and benefits to both activities. The question is really one about land use, and that is almost both a regulation and a commercial question. What is the alternative for our uplands? It is pretty much livestock production or forestry, and in a sense that is a political and economic decision for those who are on the land.

The thing that I would say is that, if we are talking about the UK, substantial meat diets with a lot of red meat are known to be unhealthy so, from a public health point of view, a reduction is important. Worldwide what we are seeing is a big increase in the appetite for meat, particularly in China and the Middle East, but less so in India, as I mentioned earlier. There are quite large areas of the world where livestock is the only possible productive activity for the land. You cannot decide whether you are going to grow livestock or you are going to grow wheat. Large parts of land do not have that as an alternative and livestock is the only way.

The thing I feel is that it really has just not been researched enough, and that is a bit of a pity. When I was in Government I was pushing to say that we need more research on this, and now I am not in Government I will still say it, but probably with a lot less effect.

Roger Williams: It is nice to hear that this is being taken seriously on a global scale.

Professor Beddington: It is.

Q88 Roger Williams: Do you think our Government is taking it seriously, either by modifying livestock husbandry or through reduction of consumption?

Professor Beddington: The research institutions that are involved are there, and you would have to ask Defra what their current plans are. I stopped being in Government in April of last year, so I am not quite so up to date with what is actually happening. As I say, it is the naked feeling of not having officials around who immediately pass me the answer to your question. I cannot answer, Mr Williams, I am afraid at the moment.

Q89 Roger Williams: You have already mentioned the great value that people in Britain put on our uplands. There may be two alternatives, either livestock production or forestation. Any change in livestock production will have huge changes in the appearance of our uplands, but also the third alternative was on *Countryfile* on Sunday night, which was George Monbiot with his concept of rewilding. Is it really important that we keep our uplands the way they are or are there real alternatives?

Professor Beddington: Again, it goes down to economics and politics. In fact, tourism is an important source of income for the country. There is a lot of tourism income that comes into the northern uplands, because they look like they do at the moment. Whether birch scrub would be quite as attractive for a tourist visit I would rather doubt. I did not see the Monbiot programme; I was told about it, so I could not comment in any detail. There are alternative uses. You can think about nature reserves and using some areas of land to be more attractive to relatively rare species. Manifestly that is there, but you are not going to do the whole of the northern uplands in that way, or at least I cannot imagine that you would.

Q90 Roger Williams: There is a lot of mention of the emissions of greenhouse gases from agriculture, but agriculture also takes in a lot of carbon dioxide every year. Are there calculations about netting off the difference between the uptake of carbon dioxide by crops, grass, and goodness knows what against the emissions? Has that been done accurately or do you think that more work needs to be done on that?

Professor Beddington: It can be done accurately. I could not answer in general. Back in 2011, I chaired an International Commission on Agriculture and Climate Change, and part of that was to say, if we are going to increase food production to the sort of levels that are needed to meet food security issues, and we continue to use the same techniques in agriculture, then greenhouse gas emissions will soar. There is a real dilemma there. One of the programmes that has started from that, which is quite substantially funded by the international community, is focusing on climate smart agriculture: i.e. agriculture that is not using substantial amounts of fertilisers that are based on using greenhouse gases, in the Haber-Bosch process and so on.

Some of the techniques that are coming are working quite well. One of the ones that has been used in parts of Sub-Saharan Africa is agro-forestry, so you have crops intermixed with trees. That has the benefit of both sheltering the crop, but also increasing production. I could probably let your clerk have reference to that particular report, and there were 10 recommendations that came out of it. One of the follow-ups from that commissioned report was to go to the climate meeting in Durban in South Africa, and make a proposal that there should be a programme for agriculture as part of the climate change discussions. That would be a really good thing. It did not get through—it was not accepted—but it still continues, because this is really important. Agriculture could be not just a problem for greenhouse gas emissions; it could be a significant solution, so your point is well taken, Mr Williams.

Q91 Iain McKenzie: Can I take you back briefly on what you touched upon in diet change. You said that the Government is encouraging diet change in all areas of the country. Governments are encouraging diet change away from certain foods that are grown traditionally. Do you see that beginning to impact on the farming community, what crops they are growing, and do you see that kind of impact in the future, as they move away from potatoes with every meal and red meats?

Professor Beddington: I would not expect it to have much effect on farming at the moment, but there are some issues. There is no doubt that there is an obesity epidemic in the developed world, but also there is an increasing problem with obesity, early-onset diabetes and early-onset cardiovascular problems in the developing world as well. They are all diet related. The irony the people point to is 1 billion people in starvation-related poverty and 1 billion people who are obese. It is one of the ironies of the world condition.

The sorts of questions that are quite interesting are not so much to do with obesity, but to do with malnutrition. Quite a lot of the crops that are grown in the developing world are insufficient in terms of key nutrients. I am sorry; I sound like a bit of a broken record, but I am chairing an International Commission, which is funded by DFID, USAID, and the Gates Foundation, to look at agriculture and malnutrition. One of the dilemmas is that countries could grow more wheat, more soya or more maize. They would do that, and it would be more profitable, but it would be at the expense of a poorer quality diet. One needs to be thinking about that and one answer is supplements; one answer is some form

of GM intervention that you can actually get better nutrient quality from particular crops. I think that is it.

In terms of the basic obesity issue, the main issues are primarily sugar-related, are they not? Most of the sugar is tending to come from sugar cane; I cannot see that this is going to have much effect on the farming community at the moment. It may do, but I doubt it. What you will see, however, is an increase in the organic movement and what is seen as healthier food, although the underlying science behind that is more debatable.

Q92 Mr Spencer: I wondered if you could explain in laymen's terms, for someone simple like me to understand, what you mean by 'sustainable intensification'.

Professor Beddington: I could see that one coming, because I read that you asked other people for that.

Mr Spencer: I still have not got the answer though.

Professor Beddington: You are going to see how consistent we all are. The idea of intensification is manifestly sensible. We do not have much land; we do have an issue of food production; we need to get more from the same amount of land. On the other hand, it would be a pretty daft thing to do to be getting more by having very large inputs of fertiliser, pesticides and so on. The intensification and the increase in product per unit area need to be balanced against how you actually do it.

Q93 Mr Spencer: In a global sense or a UK sense?

Professor Beddington: Sustainable intensification can apply to an individual farm, because you could say to an individual farm, "Can you produce more from the same amount of land by increasing some form of changing your management practice?" Now, if you are changing your management practice in a way that, for example, you ultimately might pollute your watercourses or that you are, for example, overgrazing and therefore could not continue—so you could produce vastly more sheep on the northern uplands for a while, but they would then revert to being unproductive—sustainability comes in. Intensification is more from less; sustainable intensification is not to harm the environment in a way that you cannot continue forever, whether it is overgrazing or overuse of fertilisers.

Q94 Mr Spencer: Is UK agriculture fit for purpose? Can we deliver that in our current form?

Prof Beddington: We are seeing lots of ways in which we can do it. I referred earlier, for example, to high-precision agriculture, which is actually doing that. We are looking at ways in which we can better control insect pests in a more efficient way, rather than just using pesticides. There is so-called "biological pest control" or integrated pest control. We are using that. There are a lot of indications that, for example, some nitrogen fertilisers are probably overused, and that you could probably increase the yield by cutting back. That is certainly the case elsewhere in the world, although whether a particular farm in the UK is doing that, I do not know and would not comment.

There are things that we can do to increase production. For example, our typical yields of wheat are about 8 tonnes per hectare. Rothamsted has a programme that they are following to try to get 20 tonnes per hectare from wheat. That would be a mix of breeding, agricultural practice, precision agriculture and so on, and they want to do that in

20 years. I think they started in 2012. There is a real recognition that this can be done. Elsewhere in the world, you are seeing these sorts of increases in the level of productivity.

Q95 Mr Spencer: Is that knowledge transfer trickling down to normal farmers? How are we going to get that knowledge transfer down the pyramid?

Prof Beddington: That is a very good question. The answer is that this is a thing that Government has certainly understood. I cannot believe Ian Crute did not mention the Agri-Tech strategy to you, but this is a strategy that is aimed at making sure that research actually gets used in the farming industry. It is really important. There is no point in characters in white coats sitting around in laboratories doing very, very cunning things if it does not actually come down to the farmer and have some practical use.

When I was in Government, I started the Food Research Partnership, which is ongoing and had the research institutes and the key Government Departments, but also had big agri-business organisations like Syngenta and big retailers like Marks & Spencer. It also had the National Farmers' Union and so on. Part of the programme of that was to say, "How can we better get research results to be used by the individual farmer?" This is something that I think is really important. Both the NFU and other organisations are really trying hard to get that done. Certainly, the research institutions understand that, so there is a big programme of communication.

Q96 Mr Spencer: Obviously, taxpayers' money is finite and we need to get the balance right between applied research, knowledge transfer and, I suppose, the more simplistic measures of how we can improve agriculture and the industrial environmental schemes, if you like. Where is the balance between those three different types of knowledge requirement?

Prof Beddington: We do need to be thinking pretty hard about environmental issues, but again it is a policy question. Would one wish to put aside areas of land that would be very attractive to species that are endangered? That in a sense is a straight economic choice driven by whatever regulations and incentives are out there. Other ones are much more regulation. You really would want, and you really do have, quite strong regulation, for example, on the use of nitrates to protect watercourses. You have regulation in terms of agricultural chemicals that you are allowed to use, which do actually form the mechanism of protecting the environment. You need both.

Q97 Mr Spencer: Maybe I did not frame the question in the right way. What I am saying is, to go to the extreme, you could put all of your money into research and you could let the market, if you like, trickle that knowledge down to producers. Would that be the right approach? If not, how much should Government be investing in that knowledge transfer, or is that not their job at all?

Prof Beddington: In a sense, it is a political decision. You clearly need to have some fundamental research, but it is important—and I think Government recognises that—to work out ways that that research is actually going to be used. The Agri-Tech strategy that you have all been told about, as part of that, says "We think research should be encouraged but that research needs to go into the appropriate industries," whether it is in individual farming, the processing industry or the reservation industry. These are things that need to be done. I do not think there is an easy answer, again, on what proportion of funding should be done. That is, in a sense, for debate. You can manifestly see that the

extremes are daft, but where the balance lies is, I think, a political discussion process rather than anything that you would get scientific advice on.

Q98 Roger Williams: Following on from Mark's question, in the good old days there would be an extension service like ADAS with experimental farms and things like that. Now, virtually all the advice that people get is commercial advice, which ends up with the message of "Buy my product," "Use my piece of equipment" or whatever. Do you think we have gone too far down that way? Is there a role for having an organisation that gives advice that looks at the needs of farmers and the environment?

Prof Beddington: Do you mean ADAS and things like that? That was very much the conclusion of the Food Research Partnership study. Again, I will pass that study to the clerk. I think the sorts of issues you raise are perfectly reasonable.

Chair: I would just ask you to hold fire on this, because we are coming straight on to that now.

Prof Beddington: So Mr Williams cheated, did he? He got an extra question in.

Chair: I could not possibly comment at all.

Q99 Iain McKenzie: A question just popped into my head on the subject of sustainable intensification and efficiency. Do you think a separate Scotland would re-introduce the run-rig system? You do not need to answer.

Prof Beddington: The straight answer to that is that I do not know.

Iain McKenzie: We are told there is a gap between scientific research and its translation in the application to farmers. What is your view on that?

Prof Beddington: I certainly think that we could do better. There is no doubt about it at both ends, and the sort of issues that we need to be thinking about are that the research institutes take on the activity of making certain that what they produce is actually readable, and readable by the layman. One of the most difficult things that I had when I was Chief Scientist was pronouncing the names of various chemicals, because people thought you were an idiot if you got them wrong, so I had to get my officials to give me a phonetic pronunciation before I went into a meeting. That is a cautionary tale for research institutes that would tend to produce things full of Latin names and chemical formulae that are actually meaningless to farmers. There is a proper way of actually dealing with that.

Some of the discussions that you have seen recently, for example about that GM crop producing Omega-3, were readable. It was sensible; people could understand it. It was not hiding behind complex jargon. That is one of the things that I would very much encourage and like to see. To the extent that Government can influence this, I think most people would agree that that is the right thing to be doing.

Q100 Iain McKenzie: Would you say that other EU states are better at assisting their farmers to access technical information?

Prof Beddington: Holland is very much better, but I think that that is, in part, because of the type of agriculture that they have, which is a lot involving greenhouse and a lot of fairly intensive pig and poultry. I think there are mechanisms whereby the research results get rather quicker into the farming community there, but that is an anecdotal feeling rather

than any real evidence, Mr McKenzie. I could not say, for example, whether Italy is better than France. I have no idea.

Q101 Iain McKenzie: In your opinion, what could the Government do at present to help bridge that gap?

Professor Beddington: I think that that is probably a question for my successor and maybe for the Chief Scientist in Defra. What I can speak for is the university research institutes where I am still involved and to say that it is recognised as an issue and they are trying to do it. Organisations like the Technology Strategy Board are involved in the Agri-Tech strategy, and part of their job is to move things nearer and nearer to market. When I was there, we were developing these ideas through the Food Research Partnership, and they have been followed, to an extent, by Defra.

Q102 Roger Williams: As somebody who regrets the fact that GM technology has not been adopted in this country, can you tell us if there is any way in which it can recover its acceptance by the political classes, the public and the Government?

Professor Beddington: Just to give you a flavour, I think our research institutions are right at the forefront of research in this area. The key thing here, of course, is that it is Government research and that there is no intellectual property that is retained; the intellectual property is available to all. I think that that is really rather important, because the early introduction of GM technology was very much associated with concerns that there was intellectual property, monopoly rights and so on, and that this was, in a sense, an intervention by big business which would generate more monopoly profits and so on. I think that, at that time, that was probably a reasonable concern. I do not think that that is the case now. A lot of the GM research that we have been talking about this afternoon, you will see, is coming out of Government laboratories.

The problem that we have is that there is not an evidence base that is sensible. The Chief Scientist for the European Commission, Anne Glover, who used to be Chief Scientist for Scotland, was quoted last year as saying, “I have seen no evidence that GM crops, when taken, produce any harmful effects on humans or animals.” Nobody contradicted her in saying, “Here is the evidence,” apart from some groups, and I think that that remains the case. One needs, with GM technology, to be careful, but it is not a generic thing.

There is a GM potato. Is it safe? Does it have these side effects? There is GM wheat. Is it safe? Does it have these side effects? It is not a thing that you say, *à priori*, “Let us dismiss it.” If it can solve a problem and has been properly tested for both human health and environmental safety, prohibiting it *a priori* seems inappropriate.

Q103 Roger Williams: Do you think that there was an overemphasis on the precautionary principle or was it using the precautionary principle in a way for which it was not intended?

Professor Beddington: Yes, I think there is, and I think that the use of the precautionary principle is one that I believe has been overused in arguments about not just GM technology but, for example, about agricultural chemicals. The issue that is really quite dramatic as an overuse of the precautionary principle, particularly in European legislation, has been the failure to distinguish between hazard and risk. A hazard is something that, at some large dosage, produces an effect of a carcinogen or an endocrine disruptor, but there is no distinction made on the dose. If something is a carcinogen or an endocrine disruptor,

under certain types of legislation, it would be banned anyway, irrespective that you would have to use enormous dosages to do it.

There was a case, when I was in Government, of a chemical called bisphenol A, which is used in the production of babies' bottles. The only way bisphenol A would hurt children would be if you hit them with a large container containing it. There is absolutely no evidence that the sort of dosage levels that it was coming in was any harm. It was a profound misunderstanding of the precautionary principle and the difference between hazard and risk.

Q104 Roger Williams: Do you think that the present stance that the European Union has on GM is affecting food security?

Professor Beddington: I think it is actually affecting nutrition and the way that world trade operates, because there is no doubt that, because some countries wish to export into the European Union and there are very strong regulations on GM technology, some states have been discouraged from using GM technology in a situation where they could be helped by it. I think there is a problem, but the problem is more around nutrition issues. For example, there is a strain of rice that has a vitamin A supplement which would be extraordinarily helpful in reducing blindness in children.

Q105 Chair: If we could just wrap up with a couple of quick-fire questions, if we may. Is the issue of GM not to do more with cross-contamination of other crops, being a crowded island and using the technology in this country?

Professor Beddington: I do not quite understand the question, Chair. I am sorry.

Q106 Chair: I think you answered Mr Williams' question as to there being no danger to human health. I am a sceptic on GM crops; I remain to be convinced. I thought one of the difficulties was crossover and cross-contamination on other crops nearby.

Professor Beddington: I think it is an evidence base, Chair, and the evidence is not there. There is certainly cross-contamination of GM crops into others but, in terms of the effect on human health, I know of no evidence whatsoever.

Q107 Chair: It is not to human health; it is to other crops. It is the Prince of Wales' point that you are going to contaminate crops close by, permanently.

Professor Beddington: There are appropriate regulations for spatial separation. I think that needs looking at. You would not want things to be unregulated, but you need to have proper and appropriate regulation and that is a perfectly reasonable point.

Q108 Richard Drax: Bearing in mind Professor Benton's comments about 70% of food in supermarkets containing soya, much of which is GM, we are eating this stuff anyway, are we not? It is being consumed every day, whether we know about it or not, is it not?

Professor Beddington: Yes.

Richard Drax: It is not affecting us in any way.

Professor Beddington: There are some statistics pointing to the enormous number of meals using GM product that have been eaten in North America, and there has not been one single case brought by what is a very litigious society on harm to human health that has come from eating GM-related product.

Q109 Chair: Could I just ask on biofuels? Should crops be grown for production of biofuels and does this have an impact on food security, in your view?

Professor Beddington: The simple arithmetic, of course, is that, if you grow biofuels on land, you are not going to grow food, so the answer is, in a simplistic way, yes; but it is perfectly reasonable to ask, “Could you grow biofuels on land that would not be highly productive for growing alternative arable crops or livestock?” The answer is yes, they can. The emphasis should probably be less on first-generation biofuels, which are things like sugar cane and so on, which are used to produce ethanol, but on the second and third generation, which are things that can be developed on the basis of agricultural waste. There is enormous potential for that. The BBSRC has been running a research programme on that for a long time.

Q110 Chair: In terms of the alternatives that you mentioned to uplands—and I have a very large upland area—you mentioned livestock and forestry, and you also mentioned tourism and some others. Tourism is quite important, but what contribution to food security would a nature reserve and some of the other things that you mentioned make as alternatives to livestock production on uplands?

Professor Beddington: In terms of issues to do with nature reserves, if one has an intensification of farming, so you grow more on the same amount of land, you have the scope to have reserves without affecting food security. I think that that is one of the attractions of them.

Q111 Chair: The last question: you last reported in 2011. How much progress do you think the Government has made in meeting the challenges set out in your Foresight report?

Professor Beddington: When I left Government, I was delighted in the sense that both Defra and DFID had taken a lot of the report on. I think it has had a lot of effect internationally. To the extent that, when I was there, both successive Secretaries of States took on the issue from that report and said that this had become really important and brought it up the agenda, it has been very important. There has been a change in emphasis; this is the Environment, Food and Rural Affairs Committee. Food is rather high up the agenda these days, compared with what might have been the Environment and Rural Affairs Committee if it had not happened.

Chair: Professor Sir John, thank you very much indeed for being with us.

Professor Beddington: Thank you very much.

Chair: You have been incredibly generous and very full in your answers, and we are very grateful to you.

Professor Beddington: Thank you very much.

Chair: Thank you very much indeed.