

Environmental Audit Committee

Oral evidence: Environmental change and food security, HC 880

Wednesday 25 January 2023

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Watch the meeting

Members present: Philip Dunne (Chair); Barry Gardiner; Helen Hayes; Clive Lewis; Caroline Lucas; John McNally; Dr Matthew Offord; Claudia Webbe.

Questions 1 - 30

Witnesses

[I](#): Baroness Brown of Cambridge DBE, Professor Dame Julia King, Chair, Adaptation Committee, Climate Change Committee; and Richard Millar, Head of Adaptation, Climate Change Committee.

Examination of witnesses

Witnesses: Baroness Brown of Cambridge and Richard Millar.

Q1 Chair: Good afternoon and welcome to the Environmental Audit Committee for our first oral evidence hearing in our new inquiry into environmental change and food security. We are very pleased to have with us today Baroness Julia Brown, who is the chair of the Climate Change Committee's Adaptation Sub-Committee. She is joined by Richard Millar, who is the head of adaptation at the Climate Change Committee.

I think it would be very helpful if we started off, Baroness Brown, with what you can tell us about your progress report on adaptation, which I believe is due to be published in March. This is an annual review. Could you explain to the Committee what the CCC does when looking at the issue of climate change and food security in your adaptation work?

Baroness Brown of Cambridge: Thank you very much. The role of the CCC Adaptation Committee is that every five years, on behalf of DEFRA, we pull together an independent evidence report on the risks from the changing climate to the UK. That is a very broad report. It is done a bit like an IPCC report involving 200 to 300 academics. It is not done by us. We have a role in trying to make it intelligible and making sure it is readable. We then publish every five years an advice report based on that technical evidence report about the risks and the opportunities to the UK.

Following that, the Government present their climate change risk assessment to Parliament. In June 2021, we pulled together the evidence report for the third climate change risk assessment and presented our advice report based on that. Early in 2022, the Government presented their climate change risk assessment, which draws on that report and our advice to Parliament. This year, we are expecting the Government to present their third national adaptation programme and we are expecting that around the middle of the year. That should describe the actions being taken to address the risks over the next five years. Every two years, we do an assessment of progress against the national adaptation programme—the NAP, as we call it.

In the middle of this year, we would normally be doing our second progress report on the second NAP, but because it would have come out at about the same time as the Government will be publishing the third NAP, we have pulled our report forward to the spring to try to get it out in time to give the Government further guidance on some of the things we would expect to see in the third national adaptation programme. That needs a diagram, I am afraid.

Chair: Your report will be able to inform our Committee's work, because we will certainly not have concluded by the end of March.

Baroness Brown of Cambridge: Hopefully, and hopefully it will also be of help to the Government.



If we go back to 2021, which was our last formal report, our strong message then was that we are not doing enough to adapt to the changing climate. If we compare the technical report for CCRA3 with the one five years earlier, they both cover about 61 risks and opportunities—mainly risks, sadly—to the UK. Five years before the 2021 one, 36% of those risks and opportunities were in the category of needing action now. In 2021, that had moved up to 56% in the category of needing action now—a very strong conclusion that the actions we are taking are not keeping up with the rate at which the risk is increasing.

Part of that is because our understanding of the risk is improving as the Met Office modelling improves, and as the meshes come down to finer meshes we start to learn more about the more extreme events. However, a big chunk of that is also because we have not taken enough action even for what we thought the risks were before.

Q2 Chair: Roughly what proportion of your progress reports relate to food security?

Baroness Brown of Cambridge: Clearly, we understand that telling the Government about 61 risks and opportunities is quite challenging for a busy Department, so in our advice report we flagged up eight key areas of what we said were absolutely immediate action, partly because of their urgency but also partly because there was legislation being developed—things like ELMs and the Environment Act—at that time, and we also expected new planning legislation. We gave them eight priorities for urgent action. The first four of those were all to do with nature and agriculture. Two more related to food or had some relation to food, because one of them was about supply chain risks. Of course, the food supply chain was a very important part of that. A further one was about climate change risks overseas.

Because we import some 45% or 46% of our food, and particularly something like 90% of our fruit, it is very important to us, as I think the Met Office team were telling you, that we understand the climatic impacts overseas, where they are having both heatwaves and droughts but also where, for example, daytime temperatures in the summer are getting to levels where it is not safe for people to be working outdoors, so they cannot be working picking the tea or whatever the crucial activities might be.

Of the first four areas that were to do with natural environment and agriculture, the critical areas were, for example, the condition of our soils. If we look at the assumptions in delivering the sixth carbon budget and reaching net zero, implicit in reaching net zero is an assumption that we see something like a 10% increase in agricultural productivity every 10 years between now and 2050, because we need to make space to increase the UK's tree cover in terms of extra forest and woodlands to absorb carbon from something like 13% or 14% of cover to something like 18%.



We need to be reducing the amount of agricultural land we are using for animals and for crops. We may also need to make space to grow bioenergy crops to support things like biofuels for sustainable aviation fuel. We need the productivity of our land to be absolutely at its optimum. For that, we need soils in good quality and good condition, so that they are resilient to flooding, to drought, to high winds—all the things that can degrade soils.

In summer, we are also going to see less rainfall, but when rainfall does come it will come in periods of very intense tropical rainfall—the kind of rainfall that can take the surface off the soils and can contribute to degrading them. If we want our soils to be resistant to that, we need to take measures to make sure we can maintain and improve that productivity without having to rely on adding vastly more fertiliser, because we know that will contribute to increasing CO₂ emissions.

Q3 Chair: That is an incredibly helpful overview of the demands on land use. Do you have evidence that that productivity gain is being achieved in the UK?

Baroness Brown of Cambridge: I think the answer to that is no. At the moment, we lack a soil strategy. We have not had for very many years—I cannot remember the number—a comprehensive soil survey in the UK. We do not know the condition of our soils and, unfortunately, we do not know how fast they are degrading.

Chair: We do know what the output of our agriculture is.

Baroness Brown of Cambridge: We do. We track things like wheat production. That is quite variable every year because there are a whole lot of climatic features and other issues that contribute to that. It is quite a complex thing to understand.

Q4 Chair: We were just hearing about that. Perhaps I might ask Richard about it. In the private session, we have just had some evidence about the impact of the rainfall followed by drought in 2020 reducing wheat yields by 40% in the UK in one year. Have you done any work on the impact last year, when we had an even more prolonged drought? Has that had a similar impact?

Richard Millar: Yes, it is something we are starting to look at. I think it is fair to say that it is still an emerging picture of what those impacts are, due to reporting lags for yields from last year. 2022, the summer just gone, was about as hot as 2018, so there are some parallels there. But 2018 and then the 2020 impacts that you just referred to are affected by quite a complex combination of climate events. In 2020, you saw poor conditions when planting was happening—that particularly dry spring—and weather disrupting the harvest later in the year. It is that quite complex interaction of different kinds of weather at different times of the year that caused those impacts in 2020.



It is not easy to know exactly how that reads across to 2022, but as we are getting the data in on 2022, it is something that we are very much looking at for our report and for our work in the longer term.

Baroness Brown of Cambridge: We have various bits of data for other years. In 2018, which like 2022 was one of our hottest years, we saw 20% to 40% yield losses for onions, carrots and potatoes. Back in 2016 and 2017, there was severe weather in Europe, which led to 45% to 132% price rises for imported vegetables. We do know that these climatic events are causing disruption. We do know that for internationally traded foodstuffs, like some of the grains, they sometimes cause significant price spikes as well, as you will have heard.

Q5 **Clive Lewis:** I heard an economist explaining to me that previously the global economic trading system for something like coffee, for example, was predicated on the fact that if there is a drought or a failure of a crop in one country, then the supply and demand, and the price, will mean that another country will increase its supply and make more money, and it is incentivised to do so. Globally, the system balances out.

He said that what is happening now is that you are getting multiple crop failures in multiple areas over multiple years and that the global economic system is simply incapable of dealing with that, because it is not set up for a period of perma-crisis, as we are now entering into. I think he is writing a book on it. I was interested in whether that is something that you had considered—that we are entering into a completely unprecedented realm for our economic and weather systems.

Baroness Brown of Cambridge: I will give you my gut feeling; neither Richard nor I are economists, so we will not comment on the economic analysis, but we are getting into a situation where it is not as simple as just increasing the supply somewhere else. At COP26 in Glasgow, I spoke at an event in the British Pavilion where we had a presentation from a group of coffee growers in South America. They were talking about how they were having to completely adapt the way they grow coffee and change the types of coffee they grow because their traditional ways and the traditional varieties were not able to grow in the changed climatic conditions that they are experiencing. It is not as simple anymore as saying we can grow more over here.

We need some quite dramatic changes and we need to be helping, particularly in less-developed countries, these critical suppliers to adapt and become more resilient.

Richard Millar: One thing we have had over the last few years is the assessment of the IPCC on climate impacts, which looked at the food system. They did report back. It is clear now that we are seeing the impacts of changing weather around the world on the global food system. As warming continues into the future, we will expect to see particular stresses on that system become ever more apparent.



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Again, they highlighted that the effects of that will propagate through to price and that the effects on people will often be most strongly felt by the poorest around the world, who are the most vulnerable to those price increases. It is a complex picture, but I think we are getting a better understanding.

Diversification of suppliers is an important part of a resilient food system but, in the example of coffee, there are only going to be certain regions that we can source it from, so we know that other actions working with those supply chains and producers in those countries will be another complementing part of the picture.

Q6 Chair: Water is one of the critical components in growing food. We have taken a lot of interest in water quality as a Committee, less so in supply. We have had evidence in our briefings earlier today about changes in water and rainfall, and you have mentioned that the severity is likely to increase. Has your committee made recommendations to the Government on what we need to do to maintain adequate water supplies for food production?

Baroness Brown of Cambridge: We make a lot of recommendations on water supply—more on quantity than quality, although we do not ignore quality. We have to make sure that there is enough water for people but also that there is enough water for nature, and we cannot provide enough water for people simply by taking it away from nature, because we know how important preserving and enhancing nature is for all aspects of our lives.

First, we want to see much more action on reducing demand. Like the National Infrastructure Commission, we think that the targets for reducing demand should be much more stringent. At the moment, it is about 140 litres per person per day. That has been static for about the last 10 years. We think we need to get that down closer to 100, if not below 100.

Similarly, we want to see efficiency targets for industry to reduce its water demand in line with that. We would like to see stronger progress with reducing leaks. There is a target for a 50% reduction by 2050. So far, we have seen only an 11% reduction. We would like to see that happening more quickly. We would like to see more provision for moving water from one part of the country to another, because clearly some areas, like East Anglia where we grow a lot of our salad crops, are some of the most water-stressed parts of the country and that is going to get worse.

Given that we are going to see more rain in the winter and less rain in the summer, we would like to see more focus on capturing that rain when it is there, so farmers being helped to put in place more on-farm water storage. We would like to see more support for farmers to implement more frugal water-use technologies, things like drip irrigation. There are even obvious things. I don't know in the summer how often you drive



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through the countryside and you see crops being watered in the middle of the day on a warm day, with the water evaporating off. It is good practice to water in the evening or at night when the ground can absorb the water and you are not just evaporating it into the air.

We would therefore like to see more constraints on abstraction, because that is taking water away from nature, particularly in these drought conditions. I think there are a lot more things that need to be done. I know that Ofwat has a requirement to take climate change adaptation into account, but much more needs to be done and we need to see much more progress.

Q7 Chair: I should have declared to the Committee on this subject that I am a partner in a farming business that has an abstraction licence, which is due to be reduced in 15 years' time. I am familiar with those aspects.

Finally, are there any other things that you can say at this point, ahead of your report, on what you would like to see in the Government's national adaptation programme?

Baroness Brown of Cambridge: The first thing we would like to see in the national adaptation programme, and the Government know this, is for the Government to have a vision for what a well-adapted UK looks like, because that would enable them to set targets for where we need to get to by when. That would enable everyone to be able to monitor progress: are we on track?

We have seen that that approach to reducing emissions has been pretty effective in making sure that people line up policy to align with those targets. It is crucial to have those policy targets because that is one of the things that enables investment to come in, because investors know that the targets have to be achieved. One of the challenges we have is inadequate investment in adaptation and resilience measures around the UK. That is one of the key things.

We want the NAP to be much more focused on action and implementation rather than process, which is what the previous NAPs have tended to focus on. One thing the previous NAPs have not touched on is the impacts of climate change overseas. As our earlier discussion indicated, particularly in the food security area, the impacts of climate change overseas are absolutely critical to ensuring that we maintain a diverse and secure food supply to the UK.

Q8 Dr Matthew Offord: I was a bit concerned with some of the statistics in a briefing that we had earlier, which I think you sat in on. I know that a lot of my colleagues wrote down the 40% drop in 2020, but having looked at the last 20 years of crop production, it is very volatile. If it was 9,000 million tonnes in 2020, it was about 11,000 million tonnes a few years before. You also mentioned the hottest years, but I did not see in those statistics on wheat production the same kind of drop in 2018, 2006 and 2003. I am certainly going to go back and have a look at the



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statistics and have a look at the climate variations as well.

I wanted to start with Mr Millar. What do you consider as frequent extreme weather conditions? What is your definition of “frequency”?

Richard Millar: Frequency probably depends on the exact application you are talking about. If we are talking about 2022, we have a better understanding of what the summer that we had last year is like in terms of frequency at the moment. We know, based on the climate science, that a summer like we have just seen in the UK, which was the hottest summer equal with 2018, would not have been seen at all if there had not been any influence on the climate system. We know that the frequency has gone up. Some studies estimate some of those peak temperatures we saw in the summer have increased in frequency by around 10 times. 2022 was the hottest year overall for the UK and we know that a year as hot as that would be expected around every three to four years currently.

Those statistics will keep changing as the global climate changes, so we know that the global climate will keep warming until global emissions of CO₂ fall to close to net zero. That does mean that while we will still get variations year to year in UK weather, overall hot extremes and hot summers and hot years, like in 2022, will keep becoming more frequent until we finally do reach global net zero CO₂ emissions.

Baroness Brown of Cambridge: I think the general indication is that by 2050, that will be a very typical summer. That will be an average summer rather than an exceptional summer.

Dr Matthew Offord: I am cautious about making assumptions based on past data.

Baroness Brown of Cambridge: They are assumptions partly based on past data, but they are also based on the very extensive modelling done by the Met Office and other climate bodies.

Q9

Dr Matthew Offord: The Met Office said that for the national climate series from 1884 to present, the summer of 2022 was the fourth hottest summer for daily average temperature for the UK overall. It was marginally warmer than 1976 and behind the summers of 2018, 2006 and 2003. I would certainly like to look at those figures further to see how accurate this is, because I think it is a leap of faith. I certainly do believe climate change is happening, let's make that clear, but some assertions are always made not based on evidence or fact.

One of the things I would like to ask, Baroness Brown, is about the resilience of the agricultural sector and the conditions we saw last summer. What do you think we could do as a nation to improve that resilience?

Baroness Brown of Cambridge: We have touched on some of those. If we knew that our soils were very healthy, that would help improve



resilience. If we had better water supply that did not require fighting with nature for that water supply; if the Government support to farmers, now we are replacing CAP, could support farmers in areas like East Anglia to invest in on-farm water storage so that they can collect water during the winter—things like that.

Dr Matthew Offord: Water maintenance grant.

Baroness Brown of Cambridge: There are all sorts of changes to farming techniques that I know groups of farmers in East Anglia are working on: for example, trying not to leave soil bare by growing cover crops, so that there is less chance of soil erosion; the no-till practices; some of the precision farming, so that you know exactly which part of a field needs support and you do not use excess fertiliser or you can control pests locally. There are a whole range of farming techniques that are being developed that will help us to be more resilient. Of course, there are new crop varieties that are being developed to be more drought resilient or to grow in the changing conditions that we are seeing. I think we definitely need to be supporting our farmers to make those changes.

Q10 Dr Matthew Offord: One of the points you touched on was water, and I mentioned the water management grant as well. That is only £10 million. It seems quite a small amount for the problems that you highlight. Different parts of the country obviously experience different climates. You mentioned East Anglia. I have experience in Cornwall in the west country, which is an entirely different climate, that's for sure. I do know of people in that part of the world who were seeking access to the water management grant and, as I said, that £10 million does not seem a huge amount of money. What would you like to see grants like that achieve? Some of the issues about drip-feeding of water probably would not be possible in locations such as East Anglia, which you mentioned. What are your thoughts on the WMG?

Baroness Brown of Cambridge: I agree with you. Of course, the issue about becoming resilient to climate change inevitably becomes a local issue because the geology, the soil, the weather and the crops that are grown are all local. It is quite hard to envisage solutions that necessarily will cover the whole of the country. You are absolutely right: we do need local solutions.

I think we need a lot more investment and a lot more support and education for farmers. There are some very big farms where they invest in all the latest technology, but there are lots of small tenant farmers, sometimes with quite complex tenancy contracts that are quite constraining on what they can do on their land. There needs to be a lot more information and I think Government have a role in providing that. I cannot give you a figure on the amounts of money, but I agree with you: we need to be investing more in helping farmers to become resilient and in some cases to change what they are growing.



We visited Kent County Council, where they were doing some brilliant work in supporting their local growers to move to growing soft fruit. I believe the first commercial apricot harvests are coming from some of those areas of Kent. Of course, we are also seeing in that part of the country a significant expansion in the areas of vineyards because of the change in climatic conditions. The local council were doing a great job in trying to support that transition. Local funding is required to do that.

Chair: Barry, did you want to come in on a previous question?

Q11 **Barry Gardiner:** Yes, thank you. First, remind me never to play poker against you. You deal a devastating hand with complete deadpan; it is wonderful.

Secondly, the Environment, Food and Rural Affairs Committee is going to be conducting an inquiry into soil health and soil structure, and I do hope that you will give the sort of evidence you are giving today to them in due course. If we could perhaps at a Committee Clerk level pass on the information that Baroness Brown imparted today, I think that that would be helpful.

I was troubled, though, by what you said about the potential that you saw to use some of the land and the soil land use for sustainable aviation fuel in order to facilitate aviation. I just wondered whether you had done any work on assessing the percentage of land that could be taken up by that and the impact that that would have on our capacity to grow food here in the UK, or whether it was different quality land that might be used to do that.

Baroness Brown of Cambridge: In the sixth carbon budget analysis there are some assumptions about the growth of bioenergy crops, not specifically for sustainable aviation fuel.

Barry Gardiner: I am sorry, I thought you mentioned aviation fuel.

Baroness Brown of Cambridge: I simply threw that in because the jet zero strategy makes an assumption that we will be starting to use significant quantities of sustainable aviation fuel.

Barry Gardiner: Five million tonnes by 2030, yes.

Baroness Brown of Cambridge: I do not have the number to hand, I'm afraid. You sound as if you know it. Therefore, a lot of that is coming from a biofuel route, so we will need to think about whether that is an appropriate use for land in the UK. I was not suggesting it was but, Richard, you may know the proportion of bioenergy crops—the assumption in the sixth carbon budget.

Richard Millar: I will get back to you on the specific number there, instead of getting it wrong off the top of my head. We have a range of scenarios that went into our sixth carbon budget analysis; some had more, some had less use of lands for crops going to bioenergy. It is



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important to say that we are now at the start of the process for thinking about our work towards the next seventh carbon budget advice.

Something we want to do is to take a look at our land scenario to see where evidence has moved on and particularly bring in—now that we have the Environment Act targets—a vision for what nature restoration in the UK is trying to achieve and how we can build that in as an explicit part of our scenarios, now that we have an explicit goal for what we are trying to achieve in that regard.

Barry Gardiner: Thank you very much. It would be very helpful if you could write to us.

Richard Millar: Sure.

Q12 **John McNally:** My questions are on food security in the UK. To you first, Richard, and we have already touched on this a wee bit: what is the likely impact of the projected climate change trajectories on the different food-growing areas of the UK, what areas in the UK will suffer and what other areas might benefit, and what is the likely overall impact on UK food security?

Richard Millar: We know we will see warmer and drier summers on average across the UK. What that means for water stress, which is one of the key determinants of climate impacts on agricultural productivity in the UK, is that the east and the south-east of England will be some of the regions that will be particularly stressed for water in future scenarios. Those are regions where some of our highest quality agricultural land exists. Water is going to be a real challenge for that part of the country.

There are different agricultural systems in the west of the UK compared to the east. Drought will become an increasingly large challenge, even in some of those regions where it is not thought of as a large challenge today. At the same time, wetness and too much water—particularly in winter—will also be part of the challenge. We know that winters are expected to be warmer but wetter overall. Inundation of fields and crops with water is still an important climate hazard that needs to be planned for, particularly in the west.

We know that the evidence we have suggests that the overall effects are likely to be negative. There is a set of economic models out there that try to estimate the total impacts on productivity. There is a range of numbers that come out of those, a range of quality in the model estimates, so it is quite difficult for us to pull down a specific number on it in terms of the overall economic impact today, but it is clear that many of these risks are going to make things a bit more challenging in particular years. These hotter and drier conditions and warmer and wetter conditions are the more frequent weather events we should be planning for from today.

Q13 **John McNally:** Are you working with all the different parts of the UK, like



the devolved Administrations in particular? As often as not, when you talk about the east and the west, sometimes it seems to stop from Newcastle upwards. I am very keen—and so is everybody else—to make sure that the whole of the UK is included in this, because it is vitally important that we are all working together on how these operations work. Therefore, could you confirm that you actually do that?

Richard Millar: Yes, we do. The climate change risk assessment covers all of the UK and there are bespoke products produced for Scotland, Wales and Northern Ireland that cover the specific climate hazards there. An example in this area is the potato crop in Scotland, being one of the key agricultural products that needs to be planned for, how that is going to be resilient. Yes, we cover the range of systems and geographies around the UK.

Baroness Brown of Cambridge: We are currently planning how we go about the evidence base for the fourth climate change risk assessment. Through DEFRA, one of the things we will be investing a lot more in is making the data more regionally specific and making it much easier to overlay the climate projections, the land types, the crop types and things, so that people in specific areas or regions in Scotland will be able to get a much better view of the changes they will experience and the impacts those might have.

John McNally: Are you talking about breaking things down to a smaller, more—

Baroness Brown of Cambridge: Yes, a more local level.

Q14 **John McNally:** I got that. That takes me on to the next question to yourself, Baroness Brown. As you know, the Climate Change Committee called the Government's food strategy a "missed opportunity" for the climate. It said that the plan largely failed to deliver action to drive down emissions at the scale and pace required to achieve reductions in the UK. You probably touched on this earlier, but could you set out in a wee bit more detail for us what you think is missing in terms of adaptation from the food strategy? You answered the Chair's questions earlier on about water resilience. Could you talk a wee bit more about the food side of it, please?

Baroness Brown of Cambridge: With my Adaptation Committee hat on, the food strategy does not have anything specific on actions to adapt to the threats of climate change. One of our big complaints to the Government is that so much policy addresses, for example, net zero and climate change mitigation but does not integrate adaptation alongside that.

We have to recognise that we are going to be growing these trees, or these bioenergy crops or whatever, in a different climate from the one we have today. Therefore, just as we need to build net zero thinking into lots of different policy, we have to build into our thinking the fact that the



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climate is changing. We feel that the food strategy was a real missed opportunity, because it was such an obvious one where climate adaptation should have been—

Q15 **John McNally:** Why do you think it was missed if it was so obvious?

Baroness Brown of Cambridge: I think we get this compartmentalised thinking that net zero sits in this box and biodiversity and climate resilience sit in a separate box, and we have to start thinking that these things are fundamental to our future and need to be integrated into policy thinking across the board, and that not adaptation is in DEFRA and mitigation is in BEIS and things like that. It has to be integrated and cross-Government. We had hoped that the cross-Government climate change Cabinet Sub-Committee would be doing the banging of heads together to do this, so we still hope that in future we will start to see that. We are particularly concerned that there is a lack of a clear strategy for agriculture and developing resilience to the impacts of climate change in agriculture.

John McNally: Thank you. I will leave it there, Chair.

Chair: Claudia Webbe is going to pick that up right now.

Q16 **Claudia Webbe:** My first question is to you, Baroness Brown. You have said even in this Committee that we need to have farming practices that reduce emissions and increase resilience. Could you expand on that and tell us what farming practices are needed that are associated with emissions reduction and, indeed, with that sort of agricultural practice?

Baroness Brown of Cambridge: If I go for both emissions reduction and resilience, the first is a diverse food system. We should be encouraging greater mixtures and use of rarer breeds of plants and animals, alongside those that are deemed to be the most productive. Sitka spruce is the best tree if you just want to take carbon out of the atmosphere. However, with huge forests of Sitka spruce, as soon as you get some new disease that affects Sitka spruce you have lost the entire lot. If you plant several different types of tree, you have a much more resilient plantation.

Of course, the same goes for our food system. If we use a bit bigger mixture of breeds of plants and animals, it will be more resilient. If we have landscapes where we incorporate trees, hedges and shrubs, that will be more resistant to severe winds and can slow down the effects of flooding. If we use intercropping, where you put two or more crops in the same field, that gives you extra resilience.

I have talked about the importance of cover crops for reducing soil erosion. We need to be thinking about improving soil health and also pollinator health, because of course pollinators are fundamental to a resilient food system. We need to look at low and no till. We need to be looking at frugal irrigation. We need to be looking at new, more resilient



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crops. We need to be doing things that can help us to drastically reduce fertiliser use, like a lot of the precision farming techniques.

For lowland peat, we need to look at how much we can raise the water table and do farming on a raised water table. I have seen that in East Anglia. I know how difficult it is to get fields flat enough to raise a water table, so that is a challenging one. We need to be doing more soil and carbon monitoring, and we need to be making sure that farmers have better insurance, because sometimes there will be problems that all these resilient techniques will not actually solve and we need to make sure that they are resilient as families and as businesses.

- Q17 **Claudia Webbe:** That is fairly comprehensive. Of course, the Climate Change Committee argues that we need all that in a coherent strategy that mitigates against all the climate conditions that would arise. What is preventing this strategy from emerging?

Baroness Brown of Cambridge: We are waiting with bated breath for ELMS, which is a critical opportunity. We absolutely want UK farmers to be successful businesses, to be able to continue in business and to be helped to make the changes that they are going to need to make. I think ELMS is going to be absolutely crucial in that. We are waiting with bated breath to see how it is going to tackle some of these problems and give farmers the support they need to make the changes that we will need for the future.

- Q18 **Claudia Webbe:** Will ELMS, which is the environmental land management scheme—

Baroness Brown of Cambridge: I am sorry, we are not supposed to call it ELMS either.

Claudia Webbe: Do you think that the Government's proposals within that sufficiently incentivise activities that will boost the sector's resilience to future climate impacts?

Baroness Brown of Cambridge: We do not know at the moment. We hope we have given the Government lots of suggestions for how they should make sure that the environmental land management scheme does incentivise that, and we wait to see.

Richard Millar: Yes. We need to see that next level of detail. Hopefully, we will see that in time for us to take it into account in our progress report, and certainly for our emissions reduction progress report in the summer.

What we are really looking to see, though, is for climate adaptation to be integrated into all the other objectives that that scheme is trying to promote, so the carbon sequestration, the food security and resilience, but also the nature recovery. It is going to be key to have that scheme linked with the goals that have now been set under the Environment Act for environmental improvement so that these things can deliver as a



package and not unintentionally work against other objectives in public policy.

Q19 **Claudia Webbe:** The argument is that the environmental land management scheme is limited to flood risk and not addressing some other climate impacts, such as pests and diseases. What do you say about that?

Richard Millar: We would say that it certainly needs to address the full range of climate impacts. That is what we will be looking for in our progress report—to see the extent that it will do that. The ones we have talked about today—the water stress, the heat stress, the crops, those practices that Baroness Brown just outlined, which can help address those climate risks—are ones that we will be looking forward to see how they can be supported throughout environmental land management schemes, and to what extent.

Q20 **Caroline Lucas:** To Baroness Brown first: what role do you think a reduction in meat and dairy consumption could play in improving food security and mitigating climate change? In particular—maybe to both of you—what measures could the Government take to capitalise on the trend toward plant-based diets? Richard, I noticed that the Climate Change Committee progress report to Parliament said that meat reduction is reducing at an encouraging rate, but there are no policies in place to capitalise on that momentum.

Baroness Brown of Cambridge: Reduction in red meat and dairy would be good for us all. It would be in line with the healthy eating guidelines. It does not mean that people have to stop eating meat and dairy, but to think about reducing it for the sake of all our health is a very good thing.

It can also help us to reduce emissions, and in the sixth carbon budget the various scenarios had ranges of reductions in meat and dairy from about 20% to a maximum of about 50%. The data we are seeing suggests that it is going down by about 1% a year or so—is that about the level, Richard?—which suggests we would be on track if that continued. It may not, of course, but if it continued for a 20% to 30% reduction by 2050, that would come pretty much in line with the CCC's scenario.

Eating less meat would mean less land is used overall for agriculture because, of course, animals take up quite a lot of space and we also have to grow the food crops for them. Therefore, if we eat the food crops directly, it is a more efficient way of using our land. As I have said, we need to make space to grow the trees we are going to need to get us to the “net” bit of net zero—the nature-based solutions that are going to help us to reduce emissions.

The estimates in the sixth carbon budget are that a diet change alone could release 21% of land out of agriculture by 2035 under the scenario that is called “the balance scenario”, so it could have a very big effect:



reducing the emissions from the animals themselves but also providing the land to take emissions out of the atmosphere, so a positive effect in terms of reaching net zero. Shall I hand over to you, Richard, to think about how we might drive things forward?

- Q21 **Caroline Lucas:** Just before you do, at the moment we have the sense that it is reducing by 1% a year. That brings us to where we need to be, so that is fine. On the other hand, given that there is a sense of an open door here, where people are already beginning to move in this direction, there is another argument. You could say, "Why don't you get some further purchase in an area that is already going in the right direction?" Do you feel that there is a role for the Government at all in that? The response from the Government to the Climate Change Committee was basically that they do not believe they have a role to tell people what to eat or farmers what to grow. Well, there is a difference between telling them what to eat and putting the information out there and encouraging and doing things in their own public procurement. Meat-free Mondays—there are 100 things they could be doing.

Baroness Brown of Cambridge: Nudging.

Caroline Lucas: Indeed, nudging, yes. Before I go to Richard, can I just see whether Baroness Brown thinks there is a role for the Government to do more on that?

Baroness Brown of Cambridge: I do think there is a role for the Government to do more. There is a role for Government to make sure we are as healthy as possible, to reduce pressures on the NHS, which is very much in the news at the moment. There is the role of information campaigns. We know how effective the "Eat Them To Defeat Them" awareness campaign was in schools in getting kids to eat more vegetables. We know these things work. As you say, there is quite a lot of public sector procurement that is spent on food. That could be redirected. Of course, farmers will need support to change. We are asking farmers to make quite big changes here. We know farmers are understandably emotionally attached, if they farm animals, to doing that. We need to recognise the big changes we might be asking them to make and ensure that the incentives and the opportunities are in place to help them do that.

Richard Millar: To expand on Baroness Brown's answers, you are right that diet and its implications for land use are one of the big gaps in the net zero strategy compared to the pathways that the Committee produced as part of its advice on the sixth carbon budget. We would look to see a credible vision for either how that will be delivered or how emission savings elsewhere in the economy will be made up to enable us to hit the carbon budgets and the net zero target by 2050. That is something we will be looking for through this year in our progress reports.



Where we think the Government can help is to continue that trend on diet. There is a role for public procurement in helping this along but, also, for making it easier and more attractive for people to choose reduced meat diets or meat-free products. The narrative around co-benefits is also quite important: to talk about the health benefits of reducing the overall amount of meat that we are eating on average in the country, to align with existing health guidance from the Eatwell plate, for instance, so I think there is a strong story around that.

The final piece is the land framework that was promised last year, which is supposed to provide this integrated framework of how land is going to contribute to the different goals that public policy is seeking from it at the moment. I think that is a real opportunity to tell that full, coherent story of how the Government do see these different targets being delivered and the role of diet in that, because it is an important lever within our work to help free up some land to increase the carbon stored in land. Therefore, setting out within that framework how that can be achieved and how the Government see the balance between the different options would be very useful.

Baroness Brown of Cambridge: We should, of course, be making sure that children get good climate education in schools so that they will understand the impact of diet on climate and also the impact of diet on their health.

Q22 **Caroline Lucas:** Thank you. My second question is about the role that community or urban food could play in increasing the UK's resilience to food shortages caused by environmental change, because quite often it feels as if urban food growing is seen as a bit of a side issue. Yet, when you read some of the estimates of the potential there, it could be quite huge. What are your thoughts on that?

Baroness Brown of Cambridge: I think we are on the cautious end of estimates of the role of urban food production, but we think it is hugely important because of how good it is for people from the health and wellbeing benefits of it. It is great for kids to see food actually growing. I think we are on the cautious end of how big an impact it will have on food security. There are some very specific and interesting things that are coming out, for example, on some of the vertical farming schemes. It is not that vertical farming with artificial light and irrigation is going to replace food growing in fields, but it might be able to do all sorts of important niche things.

I went to visit a vertical farming activity up near Dundee. They were growing very healthy saplings. We have a big challenge of how we are going to provide all the healthy saplings for all this tree planting we need to do without importing them from overseas, with the added danger that we might be introducing new pests and diseases into the UK, so there is a real opportunity there. They were also saying they had found a real niche. It can be difficult to grow brassicas in Scotland because at the early stages of growth some of the severe and very wet weather makes



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them rot. If you can grow them in vertical farming systems until they reach a critical size and then plant them out in the field, you can start growing broccoli extensively in Scotland.

There are all sorts of quite important niches where some of these new technologies, which could be being done in urban environments, could enhance the productivity of our farming and food growing. Therefore, I think there are some very important developments we should keep an eye on and encourage, but I do not see us moving to industrialised food production in urban areas replacing the need for farming.

- Q23 Caroline Lucas:** It is more about planning, isn't it? I was imagining more that we could make a much more specific requirement in planning regulations, for example, so that when you have new developments that that is built into it. You have things like that in France, where I think they have some rules around roofs; rooftop farms need to be on new developments in certain areas and so forth.

Baroness Brown of Cambridge: We need more green space in our towns and cities in order to make us more resilient to flooding. We need more green roofs to help with cooling buildings but also with absorbing water in city centres. If you can integrate those with producing food, it has to be a win-win, doesn't it?

Caroline Lucas: Do you want to add anything, Richard, or is that covered?

Richard Millar: No, I think that was very nicely covered.

- Q24 Clive Lewis:** We have been hearing about rising global temperatures and the impact that so-called cascades can have on food security. Do you think that the UK Government are doing enough in terms of the potential for those cascades, especially as we could hit 2 °C to 3 °C now? What are your thoughts generally on that?

Baroness Brown of Cambridge: Generally, one of the things we have been flagging up in our eight recommendations is that we need to be paying more attention to potential cascading impacts. It is not just the direct impacts on the food growing itself. As I say, it could be those increasing numbers of days when it is unsafe, from a health point of view, for workers around the equator to be working outdoors, so food cannot be harvested.

We need to be thinking about issues of transport disruption. For example, something like 25% of our imported food comes between Dover and Calais, so that is a real single point of failure in terms of weather disruption there. We need a lot more thinking and a lot more modelling about the cascading risks. It is one of the critical areas for thinking about, particularly in the supply chain areas. Richard, I am sure you have things to add to that.



Richard Millar: Yes. In terms of actions to address that, as we mentioned earlier, one of the committee's key asks has been for this next national adaptation programme to also include the risks to the UK from climate change occurring overseas. As we talked about earlier, the food supply chain is a key one—the short strait there. We know at certain times of the year that an even higher percentage share of our food is being imported—particularly vegetables from Europe—than the annual average indicates.

We know there are some critical junctures where we are particularly exposed to what is happening outside the UK for what we are consuming. So yes, I think it is important that the strategy considers the risks in the round and the set of options that we have along those supply chains to help strengthen them, whether those go to UK producers or food coming in from offshore.

Q25 Clive Lewis: There are obviously limitations on what you can do internationally—how you effect that and work towards it, and we should do that—but you can do a lot more domestically. Given the threat of those cascades, given the increasing likelihood of temperatures beyond 1.5 °C, should the Government be looking to increase the supply of produce here in this country? Is that something we should be giving serious consideration to—increasing our own capacity?

Richard Millar: It is probably a complicated answer to that question. Some level of diversity is clearly going to be an important part of a resilient supply chain. There would be some risks in bringing too much production back to the UK. For instance, our wheat-producing regions in the south and east of England are areas that could be affected by a single heatwave, like we saw last year. That larger scale and larger fractional risk to our food could potentially increase by increasing the fraction of UK food being produced domestically.

Our scenarios for how we have constructed our work on the sixth carbon budget for UK land have generally assumed that the share of food consumed that is produced domestically is held about constant at today's levels. That is our working assumption for the numbers that we have done.

The other aspect is that even if we were to produce more of the food we consume domestically, we would not be entirely removed from those international supply chains and the climate risks along them. For instance, with the inputs into those processes, things like fertiliser can themselves be subject to climate-related disruptions. Global markets for those products mean that we might still be exposed to a certain amount of price shock. It would still be important to consider how we are linked to the rest of the global economy, even if we were producing more food domestically than we have in the past.

Q26 Clive Lewis: There are a couple of things I wanted to touch on that do link into my question. You have mentioned water a lot; it has come up a



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lot. Is water an issue in this country? You would not have thought it would be, but is the infrastructure in place and is the investment going in, in your opinion, to ensure that, given that we are going to have drier summers and lots of intense downpours, we have the capacity to make the most of that in this country with the infrastructure that is being invested in by our water companies?

Richard Millar: There is definitely need for investment aligned to the climate changes we are going to see in the future. The water sector does have this climate resilience mandate passed through Ofwat to the companies. It would be important that that is used for long-term sensible planning that delivers on some of the actions that Baroness Brown mentioned earlier. Reducing demand is a key one, as well as improving the connectivity so that we are a bit more resilient in terms of the overall water system and able to move water from certain regions that are stressed at certain times from others that may be less so.

That investment is absolutely needed. Population change means that we need to invest in our water system to maintain its resilience, even without climate change. As that investment comes in, it is essential that the kinds of water stresses that we will see in the future are factored into that decision making. We know that in certain parts of the country, that is going to be particularly prevalent. East Anglia, which produces many of the key agricultural products in the UK and has some of the highest value agricultural land, is one of the regions that will be particularly water stressed. We know that the regional challenge can be much greater than we might see in the average.

Q27 **Clive Lewis:** One of the things I was interested in, picking up and trying to read between the lines of what you are saying, is it seems amazing to me that when we look at food security and the issues of having enough food to eat, we are also talking at the same time about hoping to plant more crops to end up as biofuels, potentially. That seems to be part of the plan. Does that square with the cascading future in food security?

Baroness Brown of Cambridge: If you think that you are aligning that with the changes in diet that are implicit in the sixth carbon budget—so the reduced amount of land and food crops grown to feed animals—that releases something like 21% of farmland, I think, in the core scenario. That is quite a significant chunk. Yes, you can fit all this in, but it does need investment.

Q28 **Clive Lewis:** In terms of the Government's plant biosecurity strategy, could you tell us very quickly a little bit about this policy and how well you think it has been constructed? Is it going to work?

Baroness Brown of Cambridge: We are conscious that biosecurity is a very important aspect. Looking at biosecurity in the context of the changing climate, with new pests and diseases coming in and becoming established in the UK as temperatures rise and, in some areas, as winters get significantly warmer, we do need to address this risk of pest



pathogens and invasive species. We very much welcome the strategy. We wish it had included invasive species as well, because they are an important issue. We would like to have seen it take a more holistic approach to the health of plants, livestock and humans because they are all quite closely linked.

Our preference would have been to take into account the overlapping biosecurity threats that plants, livestock and humans have. We do very much welcome it, but we do think specifically that it should have included invasive species. We do need a lot more research to understand the risks of new pests and diseases that are coming as our climate warms.

- Q29 **Clive Lewis:** I have one final question on the new sciences in the Government's Genetic Technology (Precision Breeding) Bill that is going through at the moment, and on the role of science and, in particular, genetic engineering. Is this a critical part, in your opinion, of preparing the UK for potential increased temperatures, changes to soil and changes to atmospheric conditions, and our ability to ensure that we reach our targets in terms of food supply?

Baroness Brown of Cambridge: Genetic engineering and gene editing, and processes like that, could help us to reduce emissions and improve resilience, if the public thinks that those are acceptable ways forward. Improved breeds, new varieties and hybrids, things that can produce more with less inputs clearly could give us greater resilience. Cell-based cultures that can replace animal agriculture—so artificial meats and things—could be beneficial. Clearly, one will need to understand what the cradle-to-grave emissions of some of these processes are when you take into account all the things that are needed to do them to make the correct comparisons. Improved pesticides and fertilisers are going to be important to us, particularly those that can be used much more sparingly. Smart agriculture, with the application of big data and AI, will undoubtedly be able to improve the way we farm and reduce the inputs.

Of course, we have to make sure that small farmers—farmers who are not giant groups—can access these technologies so that they can benefit from them, too. The small farmer renting land should have access to those. Food additives for livestock that reduce their methane emissions could also be helpful.

There are lots of science and technology developments that could be beneficial. Some of them will clearly be subject to the public thinking that that is appropriate. It is not for us in the Climate Change Committee to say that we must have genetic engineering, but it could be a contributor.

- Q30 **Barry Gardiner:** It has been educational getting the strategies that we need to implement a programme of adaptation through your evidence this afternoon. Most of the strategies that you have outlined are obviously referenced against the climate models that show increased average temperatures, hotter summers and wetter winters. Are there trigger events that could go against all that and disrupt it? I am thinking



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in particular of if the North Atlantic conveyor were to suddenly switch off—the Gulf Stream. Would that materially affect the strategies that seem eminently sensible against all those models? Are there other trigger events that could impact in that way?

Baroness Brown of Cambridge: I am delighted that I have a climate scientist sitting next to me, so I am going to bowl that difficult ball to Richard.

Richard Millar: There are, and it is very fair to say that that is an area where we need to understand a lot more. There are some studies and evidence out there, looking at things like the Atlantic overturning circulation and the collapse of that, and what that might mean for UK agriculture. It is a small bit of evidence, so certainly more needs to be done to make it into a rounded picture, but it does show that there might be significant challenges to some agriculture models in some parts of the UK if that were to occur.

Yes, there are these trigger events, as you said, that could produce changes that might be different from the conventional envelope. That has been one of the key points that the committee has factored into the last climate change risk assessment. Our advice on it was the need to think about those low probability events. Try to understand which actions we could be taking that might be robust to those situations, to understand those trade-offs, but then also just to take this approach of thinking through the pathways. What would that scenario mean? When would we know that that would be happening? It is something we would like to do a lot more on in the next climate change risk assessment, and certainly an important area that needs more development in the evidence base.

Chair: Thank you very much, Baroness Brown and Richard Millar, for your appearance before us today. Thank you to Nick Davies for producing our brief. That concludes this panel. We look forward with great anticipation to your progress report in March.