HOUSE OF LORDS

Science and Technology Committee

Corrected oral evidence: Nature-based solutions for climate change

Tuesday 7 September 2021

10 am

Watch the meeting

Members present: Lord Patel (The Chair); Baroness Blackwood of North Oxford; Viscount Hanworth; Lord Holmes of Richmond; Lord Kakkar; Lord Krebs; Baroness Rock; Lord Sarfraz; Baroness Sheehan; Baroness Walmsley; Baroness Warwick of Undercliffe.

Evidence Session No. 1 Virtual Proceeding Questions 1 - 8

Witnesses

Professor David Coomes, Director of University of Cambridge Conservation Research Institute; Sir Harry Studholme, Former Chair of the Forestry Commission; Dr Bonnie Waring, Senior Lecturer, Grantham Institute on Climate and Environment, Imperial College London.

USE OF THE TRANSCRIPT

This is a corrected transcript of evidence taken in public and webcast on www.parliamentlive.tv.

Examination of witnesses

Professor David Coomes, Sir Harry Studholme and Dr Bonnie Waring.

Q1 **The Chair:** Good morning, everyone, including committee members and our guests. First, welcome to George Webber, our new clerk of the committee, Thomas Hornigold, whom we all met before, our new analyst, and, of course, the indomitable Cerise. Welcome to all of you, but welcome especially to our witnesses today.

We have two sessions today. In the first session we have Professor Coomes, Sir Harry Studholme and Dr Waring. Welcome to you all. At the outset I thank you most sincerely for agreeing to help us today with our inquiry. This is the first session. We are kicking off our new inquiry on nature-based solutions for decarbonisation, so thank you very much. We are most grateful to you for agreeing to help us today.

I will kick off with the first question, which is in the context of new sites for afforestation or renewed management of forests. In the context of a nature-based solution, where do the policies fit in, and, particularly for you, Sir Harry, how do government policies in forestation fit into nature-based solutions? Professor Coomes, would you like to kick off first?

Professor David Coomes: Thank you very much. First, we need to think about what the objectives of afforestation and forest management are. The nature-based solutions approach is trying to get those elusive win-win-wins out of our management of the landscape, such as carbon capture, as a part of solving the climate crisis, as well as benefiting local livelihoods and, most importantly for me as an ecologist, helping conserve biodiversity across the land.

With that in mind as our broad definition of nature-based solutions, with regard to new sites we should be thinking about our existing ancient woodlands across the United Kingdom. We have 42,000 of those scattered across the United Kingdom due to an interesting quirk of history, namely that in the days of old when there was no transportation system to carry goods across the countryside, little patches of woodland that were left in an otherwise arable landscape were really valuable to local communities to get charcoal and timber for their houses, to build fences and so forth. The communities retained these amazing woodlands, now defined as ancient woodlands if, they have been for at least 400 years under continuous forest management, in England, for reasons valuable for them in the past.

Now, the ancient woodlands carry a lot of biodiversity in them. We really need to manage them well but also there is an opportunity to surround those ancient woodlands through planting and natural regeneration processes to connect them up, to make them bigger, and to make them better in the face of climate change. We have a real opportunity here to benefit biodiversity by building on this network of ancient woodlands. That is my first point.

Quickly, my second point—and I am sure others will touch on this—is that I do not think that planting in the lowlands is going to deliver huge benefits in terms of taking carbon dioxide out of the atmosphere. Those projects are linking together nature better. So we do need to think about where to plant over a larger scale. To do that, we do not want to impact too much on our agricultural systems, our arable systems, because if we start eating away at the land that produces our food, we will just have to go and import food from elsewhere with unknown consequences for the rest of the world.

Additionally, we do not want to plant on peaty soils because we know that is damaging—I am sure other people will talk about that. That really restricts us to planting primarily in the uplands on species poor habitats, so that the plantations are not going to be too destructive for nature if we are going to do things at scale. I will stop there and allow other people to have an opportunity to speak.

The Chair: Thank you very much. Dr Waring, please.

Dr Bonnie Waring: I concur with most of what Professor Coomes said. I think that the true definition of a nature-based solution incorporates, obviously, the carbon capture from the atmosphere but also reinforcement or protection of biodiversity across the landscape. Achieving the biodiversity aims, we really need to think at the landscape scale, so not only how many trees are in a forest but how those forests are laid out across the landscape and how they join up.

From the perspective of carbon capture, we need to think about the soils that the trees are on, which species are planted and how the forest is managed over its life cycle. To achieve the win-win scenarios, a complex set of decisions needs to be made.

The Chair: Thank you very much. By the way, I see Professor Smith, our specialist adviser. Welcome, Professor Smith, and thank you for joining us.

Sir Harry, I posed another question to you in particular.

Sir Harry Studholme: Of course. Repeat the question if I do not answer it, but the first thing to say is that the word "sequester" is two things: to capture carbon and to store carbon. It is both of those things.

The question that is being asked is partly how we store and capture the carbon but partly how we look after and protect our existing stores. A lot of that is in the soil, clearly, and we worry about that, but if you are talking specifically about trees and forests, it is stored in the wood. The miracle of a tree is that its centre is essentially dead wood, storing carbon. That is how they structurally work, putting their photosynthesising areas high into the air to shade out everything and their roots deep underground to get water and nutrients. They are inherently a carbon store.

Different types of trees grow at different rates. What Professor Coomes is talking about, which I think is really important, are our ancient woods, which have been continuously managed for thousands of years. They are

not wildwood; they are managed forests and it is critical to keep using those as a store.

To build slightly on what Professor Coomes said, the way those woods have been managed has changed significantly. The old system, which used to manage them on a coppice basis, cutting them down in the Middle Ages probably every four to eight years, and in the 18th century every 20 years, has now moved to a high-forest system, which reduces the ecology underneath but makes them a better carbon store.

Leaving them as a slow-growing carbon store is important, but they are not sequestering much carbon. For instance, on my land, where I have about 1,000 acres, which I view in a way as a carbon store, the oak plantations grow at a rate, according to the Woodland Carbon Code, that absorbs about 3 tonnes of carbon per hectare per year. On the same site, the same soil and adjacent, the Douglas fir absorbs between nine and 10 tonnes of carbon a year. Looking overall at the whole estate, the soil does different things.

When you take that microcosm into the outer world and look at afforestation and government policy, the first thing to say is that the ancient woodlands really need to be protected as an existing carbon store, but, as you expand out from there, the questions are very much about what trees you plant to get the best bang for your buck for buying carbon sequestration and subsequent storage, and how you plant trees that are most likely to protect that carbon in the long term. All the forests of this country are facing disease threats. You only have to look at what is going on in America and Russia to see what happens with wildfire. If you are designing your forests into a carbon store, you need to think very hard about their design.

The third factor, which is important, is that growth rates are affected by soils and moisture. The higher rainfall areas on the western side of the country grow trees very much faster and sequester carbon very much faster than the more arid areas on the eastern side of the country, where you start to move into other global warming and cooling effects, such as the albedo effect of the colour of the land as you change to trees.

The Chair: I have an ignorant question. Is the CO_2 that a tree stores in its centre core released when the tree dies?

Sir Harry Studholme: The answer to that is yes, over time. The trouble is that all these things are complicated and interreact with each other. From an ecological point of view, this is one of the most exciting things. You hear about oak trees supporting 2,000 species. A lot of the species that they support are the species that are dependent on that rotting process, taking the carbon and taking the tree apart. But you are absolutely right they do. There is a lot of support for planting oak trees. Sequoiadendron—a sort of big redwood lasts 4,500 years, a Douglas fir probably 1,000 and coastal redwoods probably 2,000.

Thinking about how long trees will live is absolutely important in this process, because by being alive they are producing some of the chemicals that help protect their wood from rot, or in some cases—

The Chair: I will come back to the question later on if we have time.

Q2 **Baroness Blackwood of North Oxford:** This has already been a very interesting session. Thank you so much for your answers.

I would like to understand how you view the UK Government's stated ambition to plant 30,000 hectares of new forest annually by 2025. Given some of the discussion that we have just had, how do you think that can be achieved successfully, what strategies should be undertaken to achieve it, and what barriers do you think might get in the way of achieving that goal?

Dr Bonnie Waring: As I am sure you are all aware, the Government did not meet their target of 30,000 hectares in this past year. We planted about 13,000 hectares and the majority of that was in Scotland.

From my understanding, the location of planting has to do with the grant structures that support woodland expansion, and in England and Wales those grant structures are quite complex. They are intended to support forests that protect biodiversity, which connect up patches of viable habitat and plant only with native species, but it can be very challenging for those plants to be reviewed and accepted in time for the planting season.

There is also the practical issue of nurseries. How will we ensure that there are sufficient nurseries and sufficient seed stock to support that scale of expansion?

Another thing I would like to point out is that a rapid rate of forest expansion also invokes the need to make very complex decisions about the best land to plant on and what should be planted there. So any policy structure that encourages woodland expansion is going to have to balance the need to carefully consider the ecology of the site, how to meet the objectives of the project—whether that is emphasising carbon capture in the trees or linking together biodiverse habitats and the landscape—and to implement that flexibly and rapidly such that there is not a bureaucratic barrier to the actual purchasing of the land and stocking trees on it.

Baroness Blackwood of North Oxford: Thank you, Dr Waring.

Sir Harry Studholme: It is an old chestnut and the first thing to say that as a landowner and land manager planting trees tends to be financially very unattractive. It is a very risky thing to plant something that, in the case of broadleaves, you might only get any income from in a hundred years' time, or, in the case of a conifer, maybe in 40 to 50 years' time. It is a very risky thing to do.

Looking back over a history of thousands of years, the tendency, apart from the last 100 years, has been for deforestation. Only in the last 100 years in this country, first through massive state investment and, secondly, through—I hesitate to say it—very generous subsidy at very high tax rates during the 1960s and 1970s, did we really kick off large-

scale tree planting to double the forest area of this country. It is inherently a difficult thing to get farmers and landowners to plant trees.

Secondly, there is a deep social bias against the kinds of trees that have a commercial value. People are very uncomfortable and like the idea of native species. But you technically cannot produce an oak tree in less than 120 years for all sorts of reasons now. However, that is how long it takes to produce a good oak tree, whereas you can probably grow a Douglas fir in 50 and a Sitka spruce in about 30.

Dr Waring is absolutely right about most of the planting going on in Scotland and a far more favourable government approach towards it, but there are other factors at play. The first is land prices. To make forestry work, you want to have as unprofitable an alternative use as possible, such as upland sheep farming and very low land prices, which is true in Scotland and is certainly not true in southern England, where land prices are prohibitively high.

The second thing that makes an enormous difference in Scotland is an ownership structure. A lot of the planting up until now has gone on with absentee landowners, people who are capable of big investments, taking money out of the City, and who need a certain scale of landholding in order to make a sensible investment and a structure that is designed around institutional investment rather than the social, kind of landowner/farmer-based planting.

One thing that we must do, which you have touched on, is encourage more farmer-based-landowner type planting. For instance, I am seeing the regional director of the NFU next week because one wants to get people to try to understand.

There is a further barrier, which is cultural, of people who have spent their lives farming finding it difficult to see a way as to how you might make sense of an increasingly forested environment.

Baroness Blackwood of North Oxford: Thank you, Sir Harry.

Professor David Coomes: I am just thinking what to add to that excellent response. One thing perhaps to think about is whether we have enough land available for planting 30,000 hectares a year. Of course, we have plenty of land used for agriculture and cities, and so forth, that are not suitable for large-scale planting; but is there enough unproductive land that meets the criterion of not being carbon-rich? We know that with carbon-rich soils, if we plant trees, the actual process of mechanically working the soil to plant the tree in the first place causes the peats to release their carbon as carbon dioxide. What happens is that, if you plant trees into a peatland, you have a period of perhaps several decades when the system is losing CO_2 to the atmosphere rather than drawing it out of the atmosphere, until it eventually recovers. That is a really important consideration for where we are going to plant these 30,000 hectares.

Another thing is that we do not want to plant arable land, because we will be taking food production and we will have to import food instead of growing it ourselves; and we do not want to encroach on biodiverse land elsewhere in the world.

So the simple question is: do we have enough land to plant 30,000 hectares of forest every year for the next 30 years or so? The answer seems to be yes. I am aware of three studies. The most recent is just coming out from the Royal Society for the Protection of Birds. All three have said there is enough of this cheap land, which has low productivity for arable purposes, not very biodiverse and not organic. So there are opportunities to plant that sort of area with forests across the countryside, but I think the other difficulties of persuading landowners to plant forests—linked to very real financial issues—are valid.

One last point is to think more of natural capital: not only about the commercial value of timber and land, but also valuing carbon, valuing biodiversity and the value of reducing flood risks. Once we start to put that into the equation, the Office for National Statistics tells us that forests are much more financially valuable for those other services than they are for the timber they produce. In terms of how much they are worth to society, but not currently the landowner's pocket [income], we know that the social value of these forests can be enormous. We do need to think about that in the context of incentivising change.

The Chair: Thank you very much. Thank you, Baroness Blackwood. I know some other committee members want to ask questions, but we are running out of time, so I will come back—Lord Krebs, I saw your hand up—if we have time. Please can the committee members ask sharp, brief questions and our witnesses answer as briefly as they can?

Q3 **Baroness Walmsley:** Professor Coomes, your last answer takes us very nicely to the next question, so I will come first to you with this one and then the other witnesses. What is the maximum scale that you think afforestation and forest management in the UK could contribute to greenhouse gas mitigation or drawdown? What concerns or conflicts of interest might arise from trying to implement nature-based solutions at this scale? Perhaps you might like to say more about the difference in contribution to carbon capture and carbon storage between new forests and the forests we already have.

Professor David Coomes: A few studies have looked at what we might expect in terms of drawing CO_2 out of the atmosphere. We should start by saying that, at the moment, each year, our forests take carbon dioxide out of the atmosphere and store it in their wood and sometimes in the soil. About 4.6% of the UK's greenhouse gas emissions are taken out of the atmosphere into forests. That is primarily a legacy of the history of plantation management across the UK, particularly those forests that went in 50 years ago under previous government subsidy schemes. They are maturing and taking up carbon, so we already have that service, but, over time, that sequestration, that additional carbon storage per year, is going down as those plantations reach maturity.

What are the opportunities for the future? They are going to be quite small over the long term. There are different estimates, but there is one or 2 extra megatonnes of CO_2 per year by 2030, compared with 19 megatonnes of CO_2 per year at present that is being taken up. So, not that much impact in the short term, and indeed most models looking at

trends to 2050, when we are meant to be achieving net zero, say that planting forests now is not going to have a huge impact in that timeframe. After that, we will really see the benefits of forests in taking up carbon. We should not expect in the next 20 years to see huge benefits from planting forests. They take time to establish, to form a canopy and then to start rocketing away, taking up carbon dioxide and putting it into their wood.

One of the key messages is that tree planting can be important in the longer term, but it is not going to be hugely important in the next 30 years because of the delays in taking up carbon.

Baroness Walmsley: Thank you very much. Sir Harry, you touched on the concerns and conflicts of interest in your earlier answer. Do you want to say more about that in terms of the scale we might expect?

Sir Harry Studholme: At the current level in England the conflict between farmers and their cultural values and large-scale afforestation is not a big deal, but in Scotland and Wales it is an enormous issue. That does need very significant management, and people have been working on it. Scotland has a lot of lessons in how to do it.

I echo exactly what Professor Coomes has just said about the length of time it takes to establish trees. This is particularly true with broadleaf trees. I have the Woodland Carbon Code here. An averagely growing beech plantation will absorb virtually no carbon for the first 15 years, according to the charts that I have. A lot of things take time, and that is absolutely right.

A point that I do not think is considered enough perhaps is the length of rotations. When a lot of these trees were planted, because people did not know enough, the calculations assumed shorter rotations. Certainly in southern England we are lengthening rotations. As Professor Coomes points out, the trees absorb most carbon when they really get their roots down and have a full canopy. In the case of Douglas fir, Sequoiadendron or Sequoia sempervirens, that could be hundreds and hundreds of years.

There are opportunities, although they are not talked about now, of lengthening rotations on existing forests to absorb carbon. That can be done far more quickly, but is hardly talked about, than planting more trees, which will take many decades before they really start to get motoring at absorbing carbon.

Baroness Walmsley: Thank you. Dr Waring, would you like to add anything to that?

Dr Bonnie Waring: Yes. I completely agree with the two prior responses.

I would like to talk about a few studies by the Climate Change Committee, the Royal Society and others that have tried to estimate the amount of CO_2 that these newly planted forests will be absorbing by 2050. Those estimates range between 6 and 15 megatonnes of carbon dioxide ($MtCO_2$) per year, which is between 5% and 12% of what our residual emissions will be under our current net-zero plan by 2050. That

assumes a very aggressive planting scheme, likely between 1 and 2 million hectares by mid-century, which—as we have just talked about—might be a complicated task. Because conifers—softwoods—grow so much faster in the beginning of their lifespan than broadleaves, it also relies on planting mostly conifers to achieve even that level of carbon dioxide uptake.

Achieving the targets that various committees have estimated our forests could contribute to CO_2 uptake would require both large areas of land and planting species of trees that may not be the best at providing the other ecosystem services we might be interested in, and even in so doing would make a relatively minor contribution to offsetting residual emissions.

Baroness Walmsley: It sounds as though we are in quite a difficult position, with difficult decisions to make. Thank you.

Q4 **Viscount Hanworth:** This is possibly one for Professor Coomes. How accurate are the assessments of the carbon content and the rates of carbon sequestration of forestry? Can you say something regarding your methodology, particularly where diverse habitats are concerned? We have had mention of the carbon code. Perhaps you could tell us what that is and what its quality is—how accurate it is.

The Chair: Briefly, Professor Coomes.

Professor David Coomes: I will be brief because I think the other contributors will have plenty to say on this. Where we are lacking most confidence is in what soils are doing, how they respond to the creation of a plantation and how they recover over the years following planting.

Another important consideration is what happens to wood after it dies (including through harvesting). We have talked about trees falling down in the forest, but what happens to timber after it is removed from the forest? Does it go into houses and therefore survive for a very long time after that, or does it go into paper or cardboard, or something else that ends up in landfill very quickly and therefore gets back into the atmosphere through decomposition?

If we really want to drill down and understand the benefits of planting trees for forestry, we need to understand what happens after those trees are chopped down, because that is critically important for working out the carbon benefits of forestry. I will stop there and allow others to speak.

The Chair: Thank you. Briefly, please, Sir Harry, do you have a comment?

Sir Harry Studholme: I think we understand pretty well a lot of the detail about individual trees and net carbon. We have been researching that for a very long time. Forest Research was involved 30 years ago in doing the calculations for Margaret Thatcher when she was looking at this particular area, and there has been continuous research worldwide into forests and how forests themselves absorb carbon. What we understand far less, and what in fact is the bigger carbon sink, is the soil.

Viscount Hanworth: Can you elaborate on the carbon code?

Sir Harry Studholme: To answer on the Woodland Carbon Code, the concept of sequestering carbon in trees has been around a while. There was quite a lot of activity about 20 years or so ago of people putting out schemes for people who were virtuous and wanted to try to put stuff away. Some of them were quite scurrilous and charged large amounts of money for not necessarily much mitigation.

The Forestry Commission put in place carbon registers and a Woodland Carbon Code defining what you had to do to properly absorb carbon. This is a mature scheme with audits. So, if you want to sequester carbon and—in the UK it is voluntary—get paid for voluntary carbon credits, this provides a mechanism for voluntary trading of carbon credits. I believe that a peatland one has been set up, but that has nowhere near the level of maturity and experience in putting that together.

Viscount Hanworth: It is vital for the accountancy of these matters to have a detailed carbon code.

Sir Harry Studholme: I completely agree, and the ability to trade and deal in them, but at the moment in the UK that is only a voluntary process.

Viscount Hanworth: Should we move on, or does Bonnie Waring have something to add to this?

Dr Bonnie Waring: Yes, I will be brief. Others have already mentioned the tremendous uncertainty with soils, and that is my area of expertise, so I am happy to talk more about that.

I have two points. Predictions of how much carbon a woodland can capture are based on our measurements of the stem. We know much less about allocation to roots and branches, particularly outside the most commercial species, and that could be important.

The other thing is that we can model carbon uptake fairly well in, essentially, plantations where there is a single species in the same age cohort. We have much less data to model what a naturally regenerating forest would look like with lots of different species all at different ages, so that is definitely an area where we would need more data in order to make those models robust.

Viscount Hanworth: Could you undertake to send us journal references to these various aspects? That would be helpful.

Dr Bonnie Waring: Yes. Forest Research produced a report about the greenhouse gas balance of forests in Britain that outlines many of these data gaps.

Viscount Hanworth: Thank you. You will send us the reference. I think that is it.

Q5 **Lord Holmes of Richmond:** Good morning to our witnesses and thank you for taking the time to give evidence. What would you like to see taken into account in carbon credits mechanisms for forestry projects? How would we seek to measure the effects of these interventions and

monitor their impact?

Dr Bonnie Waring: First, again, I have to make a plug for soil. Soil carbon losses can outweigh carbon gains in trees for a period of multiple decades and potentially even indefinitely if trees are planted on very deep peats. I believe that is now no longer policy; we avoid the deep peats. We know a lot less about net carbon balance on shallow peats.

I would also like to see, even though this gets tremendously complicated, more formal mechanisms for valuing the ecosystem services that forests provide, including protection of biodiversity. As Professor Coomes said, the value of forests to society is often far greater than their monetary value as timber, and that really needs to be part of these schemes.

Lord Holmes of Richmond: Thank you very much.

Sir Harry Studholme: I think one of the critical things, touching a bit on the ecosystem services, is to look holistically at a piece of land, at the landscape. If you are going to do the process, you have to monitor the quantity of carbon stored in the whole system. Looking at it in the context of paying for it to be sequestered, these things are changing all the time.

Our biggest issue, as Dr Waring was starting to touch on, is peat. The reason why peat is an issue—Dr Waring may disagree with me—is not that it is a very efficient way of absorbing carbon; it is pretty slow moving. The figures that I have here are 1 tonne to the hectare; maybe if you are really motoring you are on 3 tonnes to the hectare. So, comparing that with the Douglas fir or the oak I was talking about, it is not great. However, it is a terrific store. Thousands of years of very slow accumulation of preserved organic matter have created this carbon sink. It is about making sure that we are monitoring the sinks so that we do not keep talking only about the flux that is going on each year, because that is a small part of an enormous set of transfers that is going on.

That has to lie at the heart of it. How do we do that by monitoring? I think we are quite a way from it, but we have to gradually move along that road.

Lord Holmes of Richmond: Thank you.

Professor David Coomes: I agree with both responses. To add to these, we do need to give landowners as accurate information as possible about what the likely carbon sequestration is going to be over the next 20, 30 or 40 years so that they can be aware of what their investments might achieve in the longer term.

As Dr Waring said, we lack an understanding about carbon storage in mixed broadleaf woodlands. I do not think we have a good understanding of that in the UK compared with our plantation industries, where it is obviously vital to work out timber yields. I think improving on the system for making initial predictions is important.

I would echo the points about looking at wider ecosystem services beyond carbon when considering delivery mechanisms—particularly

biodiversity across landscapes. What are we actually achieving with these plantations?

The Chair: I move on to Lord Kakkar.

Q6 **Lord Kakkar:** I would like to turn to the question that has been touched on briefly earlier in our discussions with regard to how resilient these particular carbon sinks are; whether we have a sufficiently holistic understanding of the threats to their resilience and whether there is appropriate mitigation with regard to that understanding; and indeed whether the financial incentives are properly aligned to ensure that, if we are going to undertake this type of strategy at scale, we are going to provide resilient solutions that allow us to be confident about climate change, infection, pests, fires, et cetera. I do not know whether Sir Harry might commence and then we will proceed thereafter.

Sir Harry Studholme: I think that you have asked entirely the right question and that there is a very long way to go. I would totally concur with you that we have to move a bit of focus away from this concept of mitigation into making sure that we are adapting our forests to be resilient. It is a big problem for a number of reasons.

First, forestry change is inherently very slow. You can only change forests, when trees get felled for one reason or another, or you get the opportunity to plant a bit more, but that is a small percentage of the overall forest that is changing each year. That is the first thing.

The second thing is the cultural issues associated with forests. There is real value in ancient forests, but one of the cultural efforts is to try to recreate ancient forests that died out as a way of managing forests about 200 years ago; it became uneconomic. We are proposing these ideas of increasing native forest area. For prehistoric reasons, we have a very narrow base of native trees because of the ice ages. We are bringing in every whitebeam in Wales to say that we have 86 species, as was published the other day. But actually there are only about 30, 35, 40 common native tree species, of which a very small number are big trees. Of those big trees—the oaks, the elms, the ashes and the beeches— we have pretty much lost elm, we are in the process of losing ash, and oak is threatened in many areas. We have a major problem.

So, in order to try to create resilience, we need a cultural shift in what is acceptable as forest. Some species are treated as honorary native species, such as chestnuts, although sweet chestnut has a problem disease. Sycamore has serious problems with grey squirrels. Squirrels I will not touch on now, but they are a major issue in this whole climate question and what it is possible to establish. You are asking the right question and I could talk for hours about it, but I will stop.

Lord Kakkar: That is very kind. Dr Waring might continue with this and particularly just help us to understand what concerns we should have about resilience of the soil.

Dr Bonnie Waring: Before I address below ground specifically, I want to highlight a recent Woodland Trust report that highlighted that only 7% of

existing UK forests are in good ecological condition. That reflects a largely too homogenous age structure and lack of open space, but also a lack of dead wood. It is the organisms below ground that generate and protect the soil carbon stock that are so important to keep in mind as well, and they are very sensitive to the way that forests are managed, how soil is disturbed during planting and whether brush is cleared. Our ancient woodlands or our less intensively managed woodlands are incredibly important for hosting this whole, below-ground food web that is dependent on dead and decaying wood and that itself constitutes a huge carbon stock.

Lord Kakkar: Professor Coomes?

Professor David Coomes: Thank you. To add a little bit about pests and diseases, obviously it is a huge problem in the UK. We are all aware of ash dieback and Sir Harry mentioned other diseases attacking our native species. Also, the introduced conifers are suffering from diseases. Larches are being cleared because they have a disease called phytophthora; and Corsican pine, which is very common in this part of the country, also has a terrible disease at the moment. There are horrifying statistics about how many new pests and diseases arrive each day. In a Defra report, there are 300 on the list that are likely to attack trees and pose an immediate threat to our woodlands. That risk is regarded by many as much more imminent than climate change, which will have its consequences in the decades to come.

What we can do about pests and diseases is increase or maintain the diversity of our woodlands. Ancient woodlands are in many ways resilient to these diseases in that some species are going to succumb to them but, because there is diversity, other species can quickly take their place and refill the woodlands. But we stand a much greater risk if we stick with monoculture (single-species) plantations in the future.

Mixing trees (genetically and at the species level), there is lots we can do to reduce disease risks, phytosanitation and biosecurity. I used to work in New Zealand. The government there is very much hotter on making sure new diseases do not come to New Zealand than we are in the UK at present. We need to ensure that we minimise the flow of diseases around the world, for instance by making sure we grow our own trees for our planted woodlands rather than importing them from Europe and increasing the risk of transfer from Europe.

The third thing is to improve the structure of our woodlands so that we do not have a single layer of tree but a complex, diverse structure, which is known to increase resilience. There is also a productivity advantage; these mixed stands are good for productivity and resilience.

Lord Kakkar: Could I add one further question, Chair?

The Chair: Quickly.

Lord Kakkar: Just to be clear, are we incentivising appropriately to achieve those objectives at the moment?

The Chair: Very briefly, Professor Coomes.

Professor David Coomes: There is more that could be done here. There is interest in climate-smart, diverse forestry in future, but I do not think these approaches are entirely written in the Forestry Standard; we could be taking the opportunity to build a more resilient system for the future.

Lord Kakkar: Chair, I see Sir Harry wants to come back in.

The Chair: Very briefly, please.

Sir Harry Studholme: Very briefly, two things. One, I would say the poor quality of health in the Woodland Trust reports is based on a Forestry Commission report. One thing is the changing structure. As we move into high forest, the understorey species are shaded out, and that is an inherent problem as we have changed our methods of management away from coppice. This is not adequately discussed or explained, but it is really important.

The way to solve some of the problems that the Woodland Trust proposes as problems, which is good for raising money for it, is to move into coppice structures, which is bad for the mitigation of climate and carbon.

The second point to touch on is mixtures, which are raised quite a lot. I have spent my life trying to establish mixtures of various types and they are presented in an oversimplistic way. I do think the Forestry Standard is pretty good and pretty well debated, but you can grow only what you can grow on certain sites, and trees like to bunch together. Inherently, you are trying to create diversity in stands at all levels in terms of structure and trees that grow well together. But a lot of trees, because of the way they compete—compete towards becoming a monoculture. That is something that you are constantly battling against if you are trying to do it. You only have to look at beech forests or conifer forests. There are mixtures, but they are not mixtures with one tree—a nice little beech tree here and a redwood there. They form their own natural methodologies, and just planting for it is not necessarily the solution.

The Chair: Thank you very much. If you have time, Lord Krebs, would you also take Baroness Manningham-Buller's question, please?

Lord Krebs: Thank you, Chair. Before I start, I should declare two interests.

The Chair: Thank you. We should all be doing that. I have no interests to declare in this.

Lord Krebs: I am a member of the advisory board of the Energy & Climate Intelligence Unit and, perhaps more directly relevant to this particular inquiry, I am a scientific adviser to the energy company Drax. As you probably know, Drax burns biomass to generate electricity at its power station near Selby in Yorkshire. I would like to thank the witnesses because their answers so far have raised so many questions in my mind that I need an hour alone with them to put my questions.

The Chair: Not today, John.

Q7 **Lord Krebs:** The Chair will not allow me that, so I am going to focus on one point that has already been mentioned, which is the potential co-

benefits of nature-based solutions, for example in building resilience to climate change and increasing habitats for biodiversity. In thinking about mitigation by nature-based solutions, are there are any particular co-benefits that are relevant to the UK? Perhaps Dr Waring would like to kick off on that.

Dr Bonnie Waring: One thing that should be of particular concern to us all is pretty staggering declines in biodiversity just over the past 50 years. The biodiversity crisis and climate crisis are intertwined and really need to be addressed together. We are presented with a wonderful opportunity now. We are harnessing a lot of interest in forest expansion to benefit the climate, but if we are thinking of large-scale changes in land use, we do have the opportunity to do that in a way that makes all the rest of our ecosystems more robust and resilient. That is not just thinking about the habitat that individual woodlands can provide, but how they interface with other threatened habitats, such as chalk grassland and peat.

A very successful example of landscape-scale conservation planning is the RSPB's Futurescapes programme, which looks at linking together already protected sites through modifying the matrix habitat that connects them.

An important opportunity here is to think not just about what is planted and the soil types, but how we arrange these expanded forests in the landscape to connect habitats and promote the patchwork quilt of habitats that we know is best for biodiversity in this country.

Lord Krebs: Thank you very much. Professor Coomes, do you want to add anything to that?

Professor David Coomes: I thought that was a brilliant answer. I have little to add except I think that there are opportunities to look at these various ecosystem services. They range from the vital importance of nature for human well-being, something we all appreciate as a result of being locked away in our bedrooms for the last 18 months and only escaping to go for a walk—the vital value of nature for our human well-being. At the landscape level, we should be looking at the various services provided and thinking intelligently about how we design our landscapes to provide multiple services, and not be too preoccupied just by carbon or indeed by timber. Thinking about these services as a whole is where we need to go in the future.

Lord Krebs: Thank you. Sir Harry, do you have anything to add?

Sir Harry Studholme: First, the social aspect is very important. The really high value is afforestation close to towns and cities. The effect of Covid has demonstrated the social aspect of forestry. The Forestry Commission gets 230 million visits a year. It is the biggest provider of public outdoor recreation; having been planted really to create a resource for timber, it is actually a social resource.

Secondly, I am not completely aligned with Dr Waring and Dr Coomes about biodiversity and where it is going. I think it is absolutely critical that we think very carefully about how climate change is impacting on all

of this. My own personal experience living on the ground is that there are declines in some species but not in all species. There are more badgers and more deer; I have more goshawks and more hawfinches. I have more of all sorts of things than I would have had 30 years ago. I do not think that the 30 years of schemes to put more biodiversity into the environment have been a complete failure. I think they have by and large been quite successful.

As to number of species, the UK gets steadily more biodiverse as things get grown across the channel, but declines in abundance in certain species are worrying, and things such as the insect chain and are important, but there is a much wider, far more complex picture about how we create a climate-resistant ecology.

Lord Krebs: Thank you very much. Before I move on to the final question, very briefly, we have not really talked about urban tree planting, which has a number of co-benefits, I understand, of sequestering air pollution, providing shade and cooling, as well as the social benefit that Sir Harry has just referred to. While it is nice to have Forestry Commission sites to visit, there are many people who do not have that opportunity and it is good to increase urban tree planting. Very briefly, in a sentence, could anybody say what is the potential scale of urban tree planting in terms of carbon sequestration and these other co-benefits? Can one of you chip in on that—Sir Harry?

Sir Harry Studholme: The other co-benefits are far greater than the carbon sequestration. Secondly, I would say that the expansion of it becomes increasingly difficult as successive Governments have pushed it hard. One person's new urban forest is another person's football pitch, and the conflicts are more intense in the city.

I am sorry that was more than a sentence, but the carbon element is quite low in the cities; the other benefits are huge; and I think with climate change the shade issue becomes incredibly important.

Q8 **Lord Krebs:** Thank you very much. If I may, I am going to move on rapidly to the final question. We only have a few minutes, so I am going to ask the witnesses to give us one paragraph each. This is about the role of commercial forestry. We talked a lot about ancient woodlands and the witnesses emphasised that ancient woodlands are managed; they used to be coppiced on a more regular basis. But what about the relative importance of commercial forestry as part of the climate mitigation story? Perhaps, Sir Harry, you would kick off with a paragraph on that.

Sir Harry Studholme: It is essential; it lies at the heart of it. If you are going to have forests managed and survive into the future, there has to be an economic rationale unless the Government are going to pick up all the tabs. So commercial forestry is important. I run a forest that is profitable, at the same time I am sequestering carbon and providing biodiversity, but the heart of it is having the money to do it.

Professor David Coomes: Commercial forestry is essential for us. We need the timber products that forestry produces. It employs about 40,000 people in the UK, and we are one of the largest importers of wood

anywhere in the world. So we do need forestry; there is no question about that.

Where plantation forestry fits on the spectrum of nature-based solutions is more complicated and a dichotomy is not very helpful, actually. There are all sorts of ways of managing commercial forests and indeed natural forests. I think we need to weigh up decisions at the individual site level to see what the benefits of a given management strategy are for biodiversity, what the benefits are of producing wood for carbon storage, and think critically about these services in the process of deciding where we are going to plant what trees. That is the way forward rather than making a dichotomy between production forests and nature based solutions.

Lord Krebs: Thank you. Finally, the last word to Dr Bonnie Waring.

Dr Bonnie Waring: I will touch on the carbon angle here. In contrast to a natural forest where the carbon being sequestered is just sitting in the ecosystem, there are other pathways for carbon storage and production forests, namely use in long-lived wood products, fossil fuel substitution and concrete substitution. If we want production forests to make a robust contribution to net-zero objectives, we need to ensure that other policies are in line such that the wood gets used in long-lived products, not paper.

Lord Krebs: Thank you very much. That is me done, Chair. Over to you.

The Chair: Lord Krebs, earlier on you raised your hand. I think it was in relation to Baroness Blackwood's question. Do you want to ask that now, briefly?

Lord Krebs: Very briefly. This goes right back to the beginning about land use and the fact that we are not making any more land at the moment and, therefore, planting trees competes with other things. The Government at the moment do not have a national land use strategy. Should it?

The Chair: Sir Harry, you might be best to answer that.

Sir Harry Studholme: The answer is a difficult one. You can see in the recent things that have come out about peat and timber, and the strategies that have been produced, that the trouble with producing strategies is that, if they are done publicly, they tend to become all things to all people and become very muddled. It would be an incredibly difficult thing to do. There needs to be a framework of some sort—people need to think about it—because there are conflicts. Maybe a strategy is an idea, but it would be a brave man who puts it together, dealing with the very powerful lobby groups: NGOs, commercial interests and so on to find the way between them. It is something that needs to be thought about, even if it is sitting in a drawer, but not necessarily exposed to too much public debate.

The Chair: Thank you. There is a challenge for you, Lord Krebs.

Professor Coomes, you mentioned many diseases that affect our trees. Is there enough research being done as to how to cope with these different

diseases—just very briefly?

Professor David Coomes: Just to add, I do think there is value in developing a land-use strategy.

To address your question about diseases, I am not an expert on diseases and of course each of them is very different, but any disease that spreads by spores blown around in the wind is incredibly difficult to control once it gets into a country. That is what we are seeing with ash dieback.

The Chair: Are we investing enough in research?

Professor David Coomes: We need to invest in making sure we do not get any more diseases coming into the country, although that is somewhat unrealistic, as they will come in. There is always room for more research to understand what we can do to limit the spread of diseases once they get here.

The Chair: Thank you very much. I think I am bang on time, or just about. Thank you, Professor Coomes, Sir Harry and Dr Waring for helping us today. I have learned a lot, although I cannot speak for my colleagues. It has been most helpful to start our sessions on this new inquiry, so thank you for helping us today.

If you have any more information that you think you would like to send, please feel free to do so and we will include that as evidence. You will get a transcript, and, please, if there are any mistakes, do correct it, but thank you for helping us today. Goodbye and good morning.