



**Cynulliad Cenedlaethol Cymru  
The National Assembly for Wales**

**Y Pwyllgor Cynaliadwyedd  
The Sustainability Committee**

**Dydd Iau, 4 Rhagfyr 2008  
Thursday, 4 December 2008**

**Cynnwys**  
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Cofnodir y trafodion hyn yn yr iaith y llefarwyd hwy ynndi yn y pwyllgor. Yn ogystal, cynhwysir cyfieithiad Saesneg o gyfraniadau yn y Gymraeg. Mae hon yn fersiwn ddrafft o'r cofnod. Cyhoeddir fersiwn derfynol ymhen pum diwrnod gwaith.

These proceedings are reported in the language in which they were spoken in the committee. In addition, an English translation of Welsh speeches is included. This is a draft version of the record. The final version will be published within five working days.

**Aelodau'r pwyllgor yn bresennol**  
**Committee members in attendance**

Lorraine Barrett	Llafur Labour
Mick Bates	Democratiaid Rhyddfrydol Cymru (Cadeirydd y Pwyllgor) Welsh Liberal Democrats (Committee Chair)
Alun Davies	Llafur Labour
Lesley Griffiths	Llafur Labour
Darren Millar	Ceidwadwyr Cymreig Welsh Conservatives
Rhodri Glyn Thomas	Plaid Cymru The Party of Wales
Leanne Wood	Plaid Cymru The Party of Wales

**Eraill yn bresennol**  
**Others in attendance**

Jeff Davies	Y Gymdeithas Frenhinol er Gwarchod Adar Royal Society for the Protection of Birds
Yr Athro/Professor Mervyn Humphreys	Sefydliad y Gwyddorau Biolegol, Amgylcheddol a Gweledig Institute of Biological, Environmental and Rural Sciences
John Lloyd Jones	Cyngor Cefn Gwlad Cymru Countryside Council for Wales
Brian Pawson	Cyngor Cefn Gwlad Cymru Countryside Council for Wales
Hannah Pitt	Ymddiriedolaeth Genedlaethol Cymru National Trust Wales
Clive Thomas	Comisiwn Coedwigaeth Forestry Commission
Jared Wilson	Y Gymdeithas Frenhinol er Gwarchod Adar Royal Society for the Protection of Birds

**Swyddogion Gwasanaeth Seneddol y Cynulliad yn bresennol**  
**Assembly Parliamentary Service officials in attendance**

Dr Virginia Hawkins	Clerc Clerk
Meriel Singleton	Dirprwy Glerc Deputy Clerk

*Dechreuodd y cyfarfod am 9.03 a.m.*  
*The meeting began at 9.03 a.m.*

**Cyflwyniad, Ymddiheuriadau a Dirprwyon**  
**Introduction, Apologies and Substitutions**

[1] **Mick Bates:** Bore da, and welcome to the meeting. This morning, we will take evidence from the Countryside Council for Wales, the Forestry Commission, the Institute of Biological, Environmental and Rural Sciences, the National Trust and the Royal Society for the Protection of Birds on the role of carbon reduction via land use.

[2] I have the normal housekeeping announcements to make at the start of the meeting. In the event of a fire alarm, you should leave the room by the marked fire exits and follow the instructions of the ushers and staff. There is no test forecast for today. Please ensure that all mobile phones, pagers and BlackBerrys are switched off as they interfere with the broadcasting equipment. The National Assembly for Wales operates through the media of Welsh and English. Headsets are provided through which simultaneous translation may be received. For anyone who is hard of hearing, these may also be used to amplify the sound. Interpretation is on channel 1 and verbatim is on channel 0. Please do not touch any of the buttons on the microphones because that can disable the system. You should ensure that the red light is showing on the microphone before speaking.

[3] I have received apologies from Brynle Williams and Karen Sinclair. Lorraine will be along shortly and Alun has an engagement at around 10.00 a.m.

9.04 a.m.

**Ymchwiliad i Leihau Allyriadau Carbon yng Nghymru: Sesiwn Graffu ar  
Ddefnyddio Tir  
Inquiry into Carbon Reduction in Wales: Scrutiny Session on Land Use**

[4] **Mick Bates:** We start this morning's session by welcoming John Lloyd Jones and Brian Pawson to the table. The Countryside Council for Wales is always concerned about its carbon footprint, and we often have a video link with Bangor. We have had some unusual technical innovations to ensure that our communications remain intact during our evidence-gathering sessions. I invite you to make opening remarks for two or three minutes, and then Members will have questions.

[5] **Mr Lloyd Jones:** Diolch yn fawr, Gadeirydd. Thank you, Chair. I am John Lloyd Jones, chairman of the Countryside Council for Wales. We advise the Welsh Assembly Government on land use issues, among other things. With me this morning is Brian Pawson, our senior agriculture policy officer. You will notice that our response to your nine questions contains matters of considerable detail as well as matters of principle. The references on pages 17 to 19 show where the detail has come from. If you require further technical details from us as a result of the discussion this morning, we will endeavour to get those to you.

[6] Looking through the paper this morning, it crossed my mind that there are a few matters of principle. First, in order to achieve the target emissions reduction—which, as you know, is 3 per cent each year, or 3.7 per cent in the 80 per cent scenario—we need a big reduction as early as possible, rather than a cumulative reduction, bit by bit. If we are to reach those targets, we need a significant reduction at the front end of the timescale.

[7] Secondly, we cannot get away from the fact that agriculture is an emitter—67 per cent of methane and 84 per cent of nitrous oxide emissions in Wales are anthropogenic emissions. However, agriculture also manages 400 million tonnes of carbon in upland soils. In other words, it is a source of the problem, but also part of the solution. When we talk about agriculture, we mean 17,000 different holdings—17,000 different businesses, each with their own focus and their own aims.

[8] The third matter of principle is that carbon footprinting is in its infancy. We are trying to do some innovative work in the Cambrian mountains as part of the project, but we need exemplar projects in order to work out what we mean by carbon footprinting.

[9] The fourth matter of principle is ensuring that appropriate crops are in the right

places. It makes sense carbon-wise to target afforestation on low-carbon or existing agricultural land. However, if you do that, you run the risk of a loss of productive capacity.

[10] Low-tillage systems are good for carbon, but not quite so clever for biodiversity. One of the options under Tir Gofal is the root crop option, which is not low-tillage. The RSPB visited my farm last week to look at the root crop option in practice, and thought that it was a wonderful crop because it was very weedy. My farm manager thought that it was the worst crop of turnips we had grown for the past five or six years. So, there are trade-offs here, and people come at this from different angles.

[11] Agriculture is an emitter, but greenhouse gases in agriculture fell by 10 per cent between 1990 and 2005, as a result of lower levels of stock. However, if you have less stock, you have lost productive capacity and, sooner or later, it will have an effect on biodiversity because undergrazing becomes an issue. In other words, we need an integrated system, and when we talk about integration, in reality, we are talking about trade-offs. What should those trade-offs be?

[12] On page 13, we put forward answers to question 7 and list four components that we need: effective monitoring and modelling; an integrated policy framework; markets and payments; and technological developments and knowledge transfer. What roles should be played by regulation, by incentives, by education and by scientific research? There is a strong correlation between those last two elements—education and scientific research—because scientific research without knowledge transfer is a retrograde step. Diolch yn fawr, Gadeirydd.

[13] **Mick Bates:** Brian, do you want to add anything?

[14] **Mr Pawson:** Not at this stage.

[15] **Mick Bates:** Thank you for your excellent paper. You will be aware that we are also taking evidence from other organisations this morning. I will start by asking how you arrived at the estimate in your opening statement that 400 million tonnes of carbon are locked up in Welsh soil. I have seen other figures in evidence today as low as 125 million tonnes. Briefly, how do you arrive at such a figure?

9.10 a.m.

[16] **Mr Pawson:** We did not arrive at it. It is a figure obtained from a project that was run jointly by the Scottish Government, the Welsh Assembly Government and the Department for Environment, Food and Rural Affairs, called ECOSSE, Estimating Carbon in Organic Soils—Sequestration and Emissions. I cannot recall the figure of 125 million tonnes, but 410 million tonnes is a lot higher than previous estimates and the other figures you have seen, and the reason for that is that about 50 million tonnes plus is locked up in deeper peats, which were previously underestimated.

[17] **Mick Bates:** Given that we have some baseline data that must be fairly robust, what are the main challenges that we face in Wales in conserving carbon?

[18] **Mr Lloyd Jones:** The main challenge is to manage our upland peat soils to ensure that they do not dry out, because once they start drying out, you start losing the carbon stock—it goes either into the air or into the water. Once it starts going into the water, you have the additional problem of an extra cost on the water companies.

[19] **Mr Pawson:** The other thing that I would say about carbon is that we have couched our evidence in terms of carbon equivalents, so we have also talked about the problems

associated with methane and nitrous oxides. Agriculture contributes about 11 per cent of Welsh greenhouse gas emissions, and the bulk of that is in the form of methane and nitrous oxide. However, as John said, the issue is the carbon that is locked up. Should that start to oxidise, the implications would be very serious, because you would be talking about carbon dioxide from that carbon starting to outweigh the other greenhouse gases.

[20] **Mick Bates:** As John said earlier, with regard to some of the options under the menu for Tir Gofal and the tillage of land to plant crops, there is a conflict between the priorities of biodiversity and carbon emissions reduction. What sort of contribution can land managers make to reducing carbon emissions when there are inbuilt conflicts about ploughing up the land?

[21] **Mr Lloyd Jones:** There is a matter of proportion here. The carbon that is locked up in upland peat soils is considerably greater than the carbon released by tillage in order to plant root crops. You must also weigh that against the loss of biodiversity if you had all-grassland systems. One cannot pretend that there is a win-win situation on every occasion. Sometimes, there are conflicts and you have to work out the best way to resolve them.

[22] **Mick Bates:** Given those conflicts, what scale of contribution can land managers make to reducing carbon emissions in Wales?

[23] **Mr Pawson:** The first point to make is the contribution that could be made to reducing methane and nitrous oxide emissions. In our paper, we talk about the issue of how you start to reduce methane, when the bulk of the methane emitted is a result of digestion in grazing animals. Other people giving evidence today will also talk about this. There is a lot of work on this, which is basically being driven by market forces. For instance, the dairy industry has been doing various experiments in Wales that have demonstrated that, if you use the right dietary supplements, you can reduce methane emissions by up to 20 per cent. The French Institut National de la Recherche Agronomique has looked at using polyunsaturated fats in the diet, which it claims has reduced emissions by up to 30 per cent. So, there are things that you can do about methane through diet and, in terms of nitrous oxides, through the way in which you apply fertilisers—the timing and the type of applications.

[24] However, with carbon, it is more about how you keep it locked up. We have tried to make the point in our evidence that you can adopt an integrated approach where, by and large, it is a win-win situation. I do not think we should focus too much on the fact that, on occasion, if you want ungrazed root crops, there will be a potential conflict with carbon conservation. A lot of the time, the kind of work that you want to do for carbon conservation, for water, and for reducing flood risk, tie up with the kind of work that you want to do to reduce carbon emissions. So, there are many potential win-win situations out there.

[25] **Mr Lloyd Jones:** Absolutely. No doubt Professor Mervyn Humphreys, if he is giving evidence this morning, will elaborate on how high-sugar grass is an extremely good example of a win-win situation because the grass breeders always knew that the higher the sugar within the ruminants, the more effectively the ruminant would work. That is exactly what happened. High-sugar grasses were driven by the markets in order to make the animal more efficient so more of the plant protein stayed as animal protein or milk, and less ammonium and methane was passed. It was almost a by-product that it reduced greenhouse gases.

[26] **Mick Bates:** Nevertheless, as you stated earlier, there is some conflict between food production and locking up carbon. However, if we look at the overall position, you say that land managers in Wales can reduce carbon emissions. Is that the overview?

[27] **Mr Pawson:** Interestingly, carbon emissions from land management have reduced by 10 per cent over the last 15 years.

[28] **Mick Bates:** That is de-stocking, is it not?

[29] **Mr Pawson:** It is partly to do with de-stocking, but it is also partly due to reduced use of fertilisers. If one starts to look at some of the work that is being done on methane and nitrous oxide, you could see bigger changes than that.

[30] **Leanne Wood:** I am interested in the conflicts that you talk about. There is a potential to move towards a system of permaculture. I accept the points about reduction in production if you stop using fertilisers or reduce the amount of fertilisers that you use, but could you give us a view on whether a transformation to a system of permaculture would reduce those conflicts that you have just talked about?

[31] **Mr Lloyd Jones:** What exactly do you mean by permaculture? Are you talking about an all-grassland system?

[32] **Leanne Wood:** No; I am talking about producing food without using any external energy, such as the agricultural system that is used in Cuba, where there is localised food production without using any external energy or fertilisers. There is a reduction in production, but it outweighs the other losses in terms of carbon emissions.

[33] **Mr Pawson:** It is not something that I know a great deal about. My understanding of permaculture is, effectively, that you grow almost within a sort of greenhouse system. I think that you have to look at the lifecycle implications of that and the materials and energy that you use versus the advantages of using grazing livestock. Therefore, just from a purely carbon point of view, you have to look at the carbon implications of the whole lifecycle of growing crops in that way. You also have to look at what other things you are trying to achieve through support for land managers. We are looking at issues such as biodiversity management and maintaining water quality, but also endeavouring to reduce flood risk. I am not sure how permaculture would fit in to those wider objectives. From a biodiversity point of view, I would not have thought that it would deliver a great deal in terms of biodiversity benefits.

[34] **Mr Lloyd Jones:** The only time that I have come across the Cuban model is with this transition towns movement where it has been pointed out that, in order to help solve its food problem, Cuba has been growing an awful lot of food locally; car parks have been turned into market gardens and so forth. Interestingly enough, that system was forced upon Cuba once the communist states became unable to help it.

[35] **Leanne Wood:** That is true, and there was a lack of energy. However, as a result of that situation, food production is low-carbon and low-emitting. Biodiversity can also be encouraged because there are ways of growing certain plants and crops together to reduce plant attacks, disease, insect attacks and so forth. I think that it is something that is worth considering as a system, but it would involve the reduction of production capacity, which is obviously a problem.

[36] **Mick Bates:** It has generally been used more in horticulture rather than general agriculture. However, I think that it is worth looking at. If you have a reference to that, it would be very useful for us to look at.

[37] **Leanne Wood:** I can give you some contact details.

[38] **Alun Davies:** Diolch yn fawr am eich papur. Mwynheais ei ddarllen. Yn eich papur, gwnaethoch yn glir iawn nad ydych yn gweld llawer iawn o botensial i ychwanegu at **Alun Davies:** Thank you for your paper. I enjoyed reading it. You made it quite clear in your paper that you do not see much potential to add to the carbon sequestration that is

y dal a storio carbon sy'n digwydd ar hyn o bryd. A oes gennych dystiolaeth i gefnogi'r hyn a gredwch? currently taking place. Do you have evidence for why you believe that?

9.20 a.m.

[39] **Mr Lloyd Jones:** My understanding is that it is a natural process, which is fairly slow. I am hoping that Brian knows the technicalities and the science better than I do; I have an overview on it, but I hope Brian will be able to provide more details.

[40] **Mr Pawson:** The reason why we are focusing on conserving the carbon that is there, rather than focusing on restoring peat bogs in the hope that they will sequester more carbon, is because there is 410 million-tonnes-worth of carbon that we need to focus on first of all. Secondly, concerns have been expressed that by raising water levels you can cause anaerobic conditions to develop, in which case before the bog starts growing again and sequesters carbon, you get methane emissions in the early phases. So, in a sense, in some situations things may get worse before they get better. I am not an expert on this matter and the science on it is changing all of the time, but the focus that we have suggested is on conserving the carbon that is there, at least in the first phase, rather than heading off in the direction of sequestration, where there might be some difficulties.

[41] **Mr Lloyd Jones:** There is a reference somewhere in the paper to biochar, a new developing way of locking carbon into the soil. That is in its infancy, but the first figures look quite impressive. Whether it is practically possible to do that over a large area of land is another matter.

[42] **Alun Davies:** Diolch am hynny. Yr wyf yn derbyn y pwynt fod angen cadw carbon lle ag y mae ar hyn o bryd ac na ddylid ychwanegu at y broses o ddal a storio carbon sy'n digwydd eisoes. Pa gamau allai Llywodraeth y Cynulliad eu cymryd i gael yr effaith fwyaf ar hyn o bryd? **Alun Davies:** Thank you for that. I accept the point that carbon needs to be stored where it is at the moment and that the carbon sequestration that is currently taking place should not be added to. What steps can the Assembly Government that would have the biggest impact on the current situation?

[43] **Mr Lloyd Jones:** As Brian gathers his thoughts, I will just comment that we have made suggestions under axis 2, in relation to the present rounds of agri-environment schemes and any future Tir Mynydd schemes. At the moment, those schemes are not designed with carbon management in mind. However, they can be amended, and that is one of our recommendations. Brian, do you want to elaborate on that?

[44] **Mr Pawson:** Only to say that I think that the work that needs to be done in terms of carbon management is where agri-environment schemes are best suited. We have talked about methane and nitrous oxides, and the changes that one can bring about in that regard are driven by the market, because you are reducing greenhouse gas emissions at the same time as saving costs as a farmer. If you are using the right types of feed, you will reduce costs, and the same is true if you use fertilisers more efficiently. The issue with carbon is that there is no market reward for it at the moment, so we would argue that that is where you need to put the emphasis on using agri-environment schemes. In the longer term, we need to think about trying to establish a carbon market, which is not that easy bearing in mind that the European emissions trading scheme does not allow land management to feature within it. That is different from New Zealand, because it has a scheme that allows agricultural and forestry management to contribute to emissions trading. That does not mean that you cannot have voluntary schemes, and one can test out how those schemes would work. The issue with testing out those schemes is whether farmers or other land managers can show that something



is happening. You would pay your carbon offset, but would you get something in addition to what was happening already? Would it be permanent or would it disappear 10 years later when the management changes? Can it be verified? How much money would you have to spend going around checking that things are being done as you require? So, all of those tests that come from the Kyoto protocol apply slightly more gently in voluntary schemes than they do in the trading schemes. On the other hand, there is nothing to stop Wales from looking at some of those ideas as well, in addition to using the resources that we have in the form of agri-environment schemes to try to manage the carbon problem.

[45] **Mick Bates:** One of the problems with what you have just said is that we do not have any baseline measurements, so we do not know what each action within an integrated food chain or agricultural process means. I note in your paper that you mention that publicly available specifications have been developed by the Department for Environment, Food and Rural Affairs and ADAS. Could you just tell us what those are? Will they answer the question that many people ask, which is, if you cut down a tree, pleach a hedge or plough a field, what does that mean in terms of carbon?

[46] **Mr Pawson:** I think that we were trying to answer the question that you posed about whether we should be looking at the emissions from simply growing the food or all of the emissions that are involved in getting the food to that point, so that we would not only be looking at the carbon emissions related to the fertilizer that goes on the field, but the emissions related to getting the oil out of the ground to make the fertilizer in the first place. I think that the publicly available specifications that ADAS is working on are trying to look at this whole issue of lifecycle analysis. Our answer to your question was that, given the paucity of the data at the moment, we really think that you have to look at what happens on the farm or in the forest because we just do not have the lifecycle data there. Ideally, one should look at lifecycle data because, otherwise, we may be just exporting our carbon problem to someone else.

[47] **Mick Bates:** Is there any timescale on that work?

[48] **Mr Pawson:** I am not aware of what the timescale is for it. There is a reference in the paper that we have presented.

[49] **Mick Bates:** Yes, there is; I remember it.

[50] **Darren Millar:** Going back to the opportunities that you mentioned earlier with the common agricultural policy reforms and the axis 2 stuff, is it not crucial that there is some kind of baseline measurement of the carbon footprint in terms of where exactly agriculture is at the moment? We are not going to be able to ensure that there is something quite robust within the new axis 2 reforms unless we have an opportunity to measure what is there and to measure the outcomes afterwards. Do you think that there is insufficient data to be able to do that in any meaningful way at the moment and that the new scheme needs to be quite flexible in order to accommodate these things as time moves on?

[51] **Mr Lloyd Jones:** Yes, certainly. In our submission on axis 2 we made that very point. If we are going to have changes in the agri-environment schemes, with a greater emphasis on carbon and water issues, we need to have the baseline data right at the beginning of those schemes or it will be impossible to measure exactly their contribution and therefore their justification over time.

[52] **Darren Millar:** How important do you think that this need for flexibility is within the new regimes to make sure that they can adapt and change as the data become available? From what you appear to be telling us, there is no meaningful data at the moment, and it is going to be some time before they arrive—certainly in terms of the sequestering of carbon or the

sequestration of carbon or whatever that difficult word is—and therefore it is going to be extremely difficult to introduce something along those lines at the moment. How important do you think that the need for flexibility actually is?

[53] **Mr Pawson:** To go back to your initial question about data, there is a certain amount of data for agriculture as a whole or we would not be able to talk about the contribution. The difficulty is that the data are there for the Welsh agricultural sector as a whole, not for individual holdings, so more work could be done to look at the ecological footprint of individual holdings. As we also said, the data are not there for the individual holdings that enter schemes. In fact, most of the current agri-environment schemes that we have were not designed in an era of climate change, so they do not even require those kinds of things to be measured. In a sense, one has to go from what we know about agriculture as a whole, to what we know about certain sectors as a whole, to what we know about those people who are entering schemes. I think that flexibility is important. Obviously, we have talked about flexibility in different fora and to the Rural Development Sub-committee in relation to payment-by-results schemes and the need to try to build sufficient flexibility into prescriptions. With a lot of the work that we are talking about now, the science is still at an early stage, so one may need enough flexibility to amend prescriptions, if it was shown that you were not necessarily doing the right thing. One could interpret the question of flexibility in lots of different ways. I think that, in this context, it is important to have sufficient flexibility to change prescriptions if it is shown, through science, that you are not necessarily doing the right thing.

[54] **Darren Millar:** The other thing that you make quite an important point about is that there needs to be a regulatory framework and you, John, mentioned the incentives in your opening remarks—axis 2 is one way to get the incentives there, if you like. In terms of the regulatory framework, you mentioned earlier the opportunities for changing an animal's diet to reduce methane and other greenhouse gas emissions and ammonia emissions from that animal, but it is very difficult, for example, to introduce a new feedstuff to market. What sort of barrier do you think that that represents, and how could the Assembly Government act to reduce those barriers so that those things can move forward more quickly?

9.30 a.m.

[55] **Mr Lloyd Jones:** Part of the barrier is a lack of knowledge transfer and education. I wonder how many farmers are aware that changes in diet will lead to a reduction in methane emissions. So, better knowledge transfer would be one way.

[56] Speaking off the top of my head, you could reduce those barriers through changing farm assurance schemes to incorporate it. You could use it as a marketing advantage. In addition, ultimately, there is always cross-compliance and codes of good agricultural practice.

[57] **Mick Bates:** I am sure that that would be very popular with the industry. [*Laughter.*]

[58] **Mr Lloyd Jones:** The data in our submission shows that changing the diet has not meant a loss of production, and that is interesting. For a farmer, production remains the same. In some cases, it goes up, but the methane emission drops, and we, as an industry, ought to be looking very seriously at that.

[59] **Mick Bates:** There are several companies working on that. You mentioned the French research, but research is also being undertaken in Wales, as you may be aware. That is research into using naturally occurring chemicals that reduce methane to quite a large extent. The difficulty is that it takes some time for that research and development to develop and produce the data that we have just referred to. So, it would be some time before the carbon reduction gain from a certain action could be put into your integrated plan and an incentive

offered for that.

[60] Referring back to the question about data, Brian, I asked you specifically whether it was possible to look at an agri-environment scheme. Could you say where you are planting trees, for example, so that you could give a carbon reduction figure within the existing menu, so that it is attached? For example, would cutting down a mature hedge and pleaching it be the equivalent of reducing carbon emissions by a certain amount, because you can put that timber into a heating system?

[61] **Mr Pawson:** You would need quite a sophisticated approach. I would go back to something like the carbon audit for land manager model that the Country Land and Business Association, Savills, the European Landowners' Organisation and others have developed, under which you look at what you do on the farm. Were you to ask me that question, I would ask, 'What's your soil type? How wet is the soil? What sort of stock do you have? What do you feed your stock on?'. All of those questions would then feed back into the kind of answer that we would give. In a sense, the way to get an idea of what a scheme is doing might be to ensure that you have measurement on a farm-by-farm basis, done by the farmers themselves, so that they can get some idea of the benefits that the work that they are doing is bringing, both in terms of reduced costs and reduced carbon dioxide emissions. You can then aggregate that across your scheme. In order to go to a scheme administrator and say, 'Can you add up the benefits of all this tree planting or bog restoration work?', you would need so much data about individual places. You need to devolve the measuring work, to a certain extent, down to the people who are doing the work.

[62] **Mick Bates:** In your opening remarks, you said that there are 17,000 farms that return the data. Is it practical to collect individual sets of data from 17,000 businesses? There are lots of other land managers; we are just talking about those who collect the single farm payment.

[63] **Mr Lloyd Jones:** No, but, again, using the Cambrian mountains initiative as an example, it is intended that the participating farmers will try to work up a way of each one calculating his own individual carbon footprint. Out of that, it may well be possible to devise a common methodology. Another way of looking at it might be to make an amendment to the farm business survey that takes into account something like this.

[64] **Mick Bates:** I do not think that that was part of the paper, was it?

[65] **Mr Lloyd Jones:** No, that was not in the paper. However, it is something—

[66] **Mick Bates:** The question is: how do you ask that of an individual business? Rhodri, you want to come in on this.

[67] **Rhodri Glyn Thomas:** Ar yr union bwynt hwnnw, o ddarllen eich papur a gwrando ar eich tystiolaeth y bore yma, ac o ystyried rôl statudol Cyngor Cefn Gwlad Cymru i gynnig cyngor i Lywodraeth Cymru ar y materion hyn, yr wyf yn ei chael yn anodd deall beth yn union yr ydych yn galw ar Lywodraeth Cymru i'w wneud—gofynnwyd y cwestiwn hwnnw gan Alun a Darren.

**Rhodri Glyn Thomas:** On that exact point, from reading your paper and listening to your evidence this morning, and having considered the statutory role of the Countryside Council for Wales in providing advice to the Government of Wales on these matters, I find it difficult to understand what exactly you are calling on the Welsh Government to do—and this question was raised by Alun and Darren.

[68] Yr ydych yn dweud pa mor gymhleth ac anodd ydyw, ac yr ydych yn sôn am You say how complicated and difficult it is, and you mention the deficiencies in the data,

ddiffygion o ran y data, ond nid ydych yn dweud wrthym beth fyddai eich cyngor i Lywodraeth Cymru ynglŷn â beth yn union sydd angen ei wneud. Felly, fe'ch cyfeiriau at ddau beth penodol. Yr ydych wedi cyfeirio at y fethodoleg o geisio mesur yr ôl-troed carbon. Beth yn union yr ydych yn awgrymu y dylid ei wneud yng nghyd-destun casglu'r data hynny? Mae'n ddigon hawdd dweud bod 17,000 o ffermydd a'i bod yn anodd cael y data, ond beth sydd angen ei wneud o ran casglu'r data hynny? Heb y data, ni allwn wneud llawer o ran gweithredu ar y mater.

but you do not tell us what your advice to the Government of Wales would be with regard to what exactly needs to be done. Therefore, I refer you to two specific points. You referred to the methodology of attempting to measure the carbon footprint. What exactly do you suggest should be done in the context of collecting those data? It is easy enough to say that there are 17,000 farms and that it is difficult to gather the data, but what needs to be done with regard to the collection of those data? Without the data, there is little that we can do in relation to this matter.

[69] Yr oedd gennych un pwynt arall a oedd yn syndod. Y rhagdybiaeth oedd bod coedwigaeth, a phlannu coed yn benodol, yn llesol iawn o ran lleihau'r allbwn carbon. Yr ydych yn awgrymu y dylid adolygu pa mor werthfawr yw hynny. Pam yn union yr ydych yn dweud hynny?

You raised another point that was surprising. The presumption was that forestry, and planting trees specifically, is beneficial with regard to reducing carbon emissions. You suggest that the benefits of this should be revised. Why exactly do you say that?

[70] **Mr Lloyd Jones:** Brian, will you take the question about what we are proposing? I will take the last question. We are pointing out the need for the appropriate crop to be planted in the appropriate place. There is evidence that planting trees on upland peat bogs means a net carbon loss, not a net carbon gain. So, it is about having the appropriate tree in the appropriate place. That is what we are saying.

[71] Brian, do you want to deal with the first part of our question, regarding the recommendations? I thought that they were quite clear—changing what you can change, namely the agri-environment schemes.

[72] **Rhodri Glyn Thomas:** What changes are you suggesting?

[73] **Mr Pawson:** First, that we use our axis 2 schemes in a more integrated way to ensure that we get the carbon management benefits that we are looking for, but that we also integrate that with water and biodiversity so that we get more value for our euro spend.

[74] **Rhodri Glyn Thomas:** Fine, but what does that mean in practical terms?

[75] **Mr Pawson:** Doing the kind of work that the committee examined at Lake Vyrnwy, where the work has included blocking grips, starting to restore peat bogs—not necessarily because you are looking for those peat bogs to sequester more carbon in the immediate future; you are looking to keep them wet enough to ensure that they do not dry out, oxidise and lose their carbon. However, by doing that, you are also reducing the amount of dissolved organic carbon that starts to go down into the water supply that it then costs money for the water companies to remove, you are starting to reduce the problems of diffuse pollution that affect biodiversity, and you are starting to restore your bogs in a way that will ensure that breeding birds of blanket bog are conserved. So, you are getting multiple benefits. That is the first point.

[76] **Rhodri Glyn Thomas:** Would you build those into the agri-environment schemes?

[77] **Mr Pawson:** Yes, build such things into the agri-environment schemes. These are the things that have been talked about in the current consultation, particularly option 2 and option

3.

[78] The second thing is that the schemes are not currently focused on gathering the kinds of data that one needs. One can either go out and gather them oneself, in which case, we will be spending a lot of money, because there are 17,000 claimants of the SFP, let alone the number of farms in Wales, which is rather larger. One of our suggestions would be that, if you build carbon footprinting—something along the lines of the carbon accounting for land managers model—into your agri-environment schemes, then the farmers who are doing the work can gather the data themselves and see the benefits of what they are doing. You can build the cost benefits of doing that work into such an exercise. Regulation is a cost, but many farmers are doing this kind of work in order to reduce nitrous oxide emissions and are thinking about reducing methane emissions, because they are thinking about their own costs. If you move away from agri-environment schemes and try to use regulation to force such changes, you are driving the research agenda forward.

9.40 a.m.

[79] So, there are things that one can do on the regulatory side as there are things that one can do on the knowledge transfer side, but I think that one can build a lot of these things, particularly to do with gathering data, into our agri-environment scheme.

[80] **Rhodri Glyn Thomas:** Those would be people who are signing up for the first time, or renewing their agri-environmental schemes; it would not be relevant to those people who are already in those schemes.

[81] **Mr Pawson:** I think that one would look at the points at which the scheme comes to an end or you reach a break clause.

[82] **Leanne Wood:** You call for an integrated approach. As you know, this committee has been focusing on carbon emissions but, as you point out, the agriculture sector emits other greenhouse gases. Can you tell us what the significance is of developing an integrated approach to greenhouse gas reduction that includes nitrous oxide and methane?

[83] **Mr Pawson:** Essentially, agriculture emits 11 per cent of the greenhouse gas emissions for Wales as a whole, and emits 2 per cent of that in the form of carbon. The bulk is emitted in the form of nitrous oxides and ammonia. So, if you want to reduce the actual emissions of agriculture at present, you need to do more on nitrous oxides and ammonia, but if you want to ensure that the land on which agriculture is taking place does not become a major emitter in the future, we need to think about how to manage those carbon stores in the near future.

[84] **Leanne Wood:** How would that integrated approach work in practice, and how could such an approach be effectively monitored?

[85] **Mr Pawson:** I think that it comes down to the kind of example. I have given the example of Lake Vyrnwy but there are quite a few other examples across the United Kingdom that we have put in the paper. There is work that United Utilities is doing in Lancashire, and there is work that the National Trust is doing in High Peak, Derbyshire. There is also a good example in reference 38 in the list, Moors for the Future partnership, which I mention purely because it produces a very nice summary sheet that makes the point about the various ways in which you bring together all of the things that we have been talking about, including water quality, particularly the issue of how you deal with the dissolved organic carbon, which I think is fascinating. I think that the National Trust mentioned this in its evidence but, essentially, it is an end-of-pipe solution. Do you basically try to take the carbon out when it reaches the water treatment works and clogs it up, or do you spend the money on managing

the land in such a way that you reduce costs? We allude to the fact in our evidence that the periodic review of water pricing allows water companies to go to Ofwat and say, 'We want to spend a certain amount of money in order to enhance the management of our uplands because the bottom line is that it will reduce the costs of us managing our water resources'. To me, it seemed that, in terms of water prices, Ofwat should say, 'Well, surely water prices should go down as a consequence of that'.

[86] The bottom line is that you still need the water treatment works—you cannot get away without the water treatment works. The spend on land management ensures that you do not need to service your water treatment works quite as often. I think that Ofwat has also accepted that, if we want food at a particular price, the same consumers who want food at a reasonable price would also like their water at a reasonable price. The bottom line is that one has to pay somewhere along the line for these desirable things to happen. As I understand it, Ofwat has accepted the point that money can be spent in this way.

[87] **Mick Bates:** Darren, you have a question about the capacity and influence of advisory roles.

[88] **Darren Millar:** Yes, but before I go on to that, I want to ask another question. You talked earlier about the right trees in the right place, and the opportunities to sequester carbon. Can you give us some more information on that? I note that, in the paper, you refer to some loss of carbon—around 13 per cent—from the soil due to some trees being planted—

[89] **Mr Pawson:** That was part of the ECOSSE report produced after a very small-scale study on planting birch on peat land. Part of the problem is that you may need to do some drainage work to plant trees on peat land, which would involve a degree of drying out. The carbon that you are sequestering within the trees is outweighed by the carbon that you have lost as the peat dries out. That is not to say that we do not agree that planting trees is not a means of sequestering carbon; it is simply a matter of planting the right trees in the right places.

[90] **Darren Millar:** Turning to another part of your paper, you make reference to the potential for a carbon trading scheme, or a greenhouse gas emissions trading scheme. How do you think that might be achieved, given that it would not be allowed under the existing arrangements?

[91] **Mr Pawson:** There are schemes—and I am not sure whether 'mandatory' is the right word, but they are regulated—like the European emissions trading scheme, which is a cap-and-trade scheme. You are permitted to reach a certain level of emissions, and, as emitters, you can trade those emissions with each other. Other schemes are voluntary. For example, after taking a flight somewhere, I could decide to offset my carbon emissions, and so I could go to a company that undertakes to facilitate the management work to cover the carbon emissions of my flight, whether by sequestering carbon through peat land restoration or through tree planting. Ideally, these voluntary schemes still need to pass the tests from the Kyoto protocol that I alluded to. You need proof that the person doing this extra work would not have done it anyway. They need to show that they will not stop doing it in five years' time, and that someone has been out and verified that work. The classic example would be if I paid to offset my flight, and so did John and someone else, but we all paid for the same single piece of work. So, you need a management system. However, voluntary schemes can operate within that context. Unless you meet those criteria, you are not really delivering the benefits that you are looking for.

[92] **Darren Millar:** Do you envisage a time when farmers will pay other farmers, so that the scheme operates exclusively within the agricultural and land-management sector, rather than having a national scheme that involves other businesses and perhaps even individuals?

[93] **Mr Pawson:** We need to start by building these things up from the base. We are doing some work. We alluded to a project called Tir Cloi, which involves the Environment Agency, the Wales Sustainability Reinvestment Trust, and us. We are looking to support a project officer through grant aid, who will try to establish the link between those who are prepared to put funding into the system and those who will carry out the work. That is between the general public and the land manager. Such a pilot approach would allow us to scope out some of the problems associated with verification and additionality. As to whether we could see land managers starting to trade carbon with each other, we see that coming down the track, but the details need to be sorted first. We probably need to do rather more than one pilot project. If we are looking at the kind of things that can be done by Government, the recommendation was that, by 2020, this should be looked at and tested out. The Department for Environment, Food and Rural Affairs has rejected a mandatory approach, but not a voluntary one.

[94] **Mick Bates:** Lesley, would you like to come in on the carbon trading issue?

[95] **Lesley Griffiths:** Brian, you mentioned that voluntary schemes might be worth looking at if we could set up a carbon trading scheme. You mention in your paper the New Zealand emissions trading scheme. Could you outline how such a scheme might operate in Wales?

9.50 a.m.

[96] **Mr Pawson:** We are trying to work through the Tir Cloi approach to scope out some of the difficulties of additionality and verification. However, that is as far as we have got in trying to start building the system. For the scheme to work at a Wales level, we probably need rather more pilot schemes, and we need to learn the lessons from them before introducing the scheme Wales wide. I do not know a great deal about the New Zealand scheme, but it is interesting that they have gone for a land management component in their emissions trading scheme. However, I am fairly sure that it is because they have a large number of livestock over a large area. They do not have the kind of major installations that we have in Europe, so land management is a much bigger component of their total emissions. Therefore, there are probably lessons that one could learn from the New Zealand approach, because they are forced to look at land management as it is such a big component of the problem, as they see it.

[97] **Mick Bates:** Of course, we can introduce our own trading scheme under the Climate Change and Sustainable Energy Act 2006, which could be significant. You talked earlier about incentives to carbon trading. What sort of price are you putting on a tonne of carbon?

[98] **Mr Pawson:** I would not want to say.

[99] **Mr Lloyd Jones:** That depends on whether you are buying or selling. [*Laughter.*]

[100] **Mick Bates:** As we are all aware, that is the critical issue. As we know from the emissions trading scheme, that price is critical to drive the whole thing. I believe that you want to come in on this too, Rhodri.

[101] **Rhodri Glyn Thomas:** Yr wyf yn dod yn ôl eto at yr oblygiadau ymarferol i hyn oll. Yr ydych wedi sôn, o ran casglu'r data, beth y gellid ei wneud o ran ein cynlluniau amaeth-amgylcheddol. Fodd bynnag, nid pawb sy'n rhan o'r cynlluniau hynny. Mae dadl ynghylch a yw Tir Mynydd

**Rhodri Glyn Thomas:** I still come back to the practical implications of all this. You have mentioned, on the data collection, what can be done through our agri-environment schemes. However, not everyone is part of those schemes. There is an argument about whether Tir Mynydd is an agri-environment

yn gynllun amaeth-amgylcheddol ai peidio; byddai hynny'n cynnwys darn go lew o dirwedd Cymru. scheme or not, and that would include a large portion of Wales's landscape.

[102] O ran gweithredu yn y mater hwn, ac a ddylai hynny fod yn wirfoddol neu'n orfodol, os yw Llywodraeth y Cynulliad i wneud rhywbeth ymarferol yn y maes hwn, a ddylai hynny fod yn wirfoddol neu'n orfodol? A ddylai gynnwys ffermydd yn unig, neu'r holl gwmnïau a sefydliadau eraill sy'n rhan o'r broses hon? Sut ydym yn mynd i gael unrhyw weithgaredd sy'n cynnwys pawb i weithredu yn y mater hwn? When it comes to acting on this issue, and whether that should be voluntary or mandatory, if the Assembly Government is to do anything practical in this area, should that be voluntary or mandatory? Should it include farms only, or all the other companies and organisations that are a part of this process? How are we going to get any form of activity that will include everyone to act on this issue?

[103] **Mr Pawson:** We started with agri-environment schemes because we know about them, having run two. I personally do not regard Tir Mynydd as an agri-environment scheme, but I will not go into that. How do we deal with non-agri-environment participants? We suggested that one way to deal with carbon calculations on agri-environment schemes is to make it a component of the scheme. I am thinking as I go here, but I would hesitate to say that one should make—

[104] **Rhodri Glyn Thomas:** If you are not taking Tir Mynydd as an agri-environment scheme—and I probably agree with you on that—the number of farms in agri-environment schemes is very small.

[105] **Mr Lloyd Jones:** Yes. However, it is not only agri-environment schemes, is it? One thing that we have outlined is knowledge transfer, and getting farmers to understand that a change in diet does not mean a loss of productivity but a lessening of emissions.

[106] **Rhodri Glyn Thomas:** You are talking about doing it voluntarily then, are you?

[107] **Mr Lloyd Jones:** No, as a combination. That is actually a market incentive. There is a combination of voluntary schemes, market incentives, and regulation. However, it is getting the appropriate balance and the right mix.

[108] **Mr Pawson:** It is also about what you are trying to incentivise and regulate. If you are trying to gather data on the emissions of individual farms, you are much better going down the route of using services such as Farming Connect to try to encourage farmers to record these data by demonstrating that doing it makes sense, not just for climate change but for their bottom line. Otherwise, if you try to regulate data collection, would we have that much trust in the data that came back? On the other hand, if you were trying to regulate certain approaches regarding the use of feeds, even then, you are better off trying to go down the route of encouragement. There are certain things that one could use regulation for, because cross-compliance already includes three major components relating to soil management. So, we have demonstrated that you can use regulation, but you do so as a way of incentivising participation in voluntary approaches and as a way of incentivising research.

[109] **Mr Lloyd Jones:** It is an interesting concept that you can regulate behaviour, because, in effect, that is what you are suggesting under the regulatory rule.

[110] **Rhodri Glyn Thomas:** I was only asking a question. [*Laughter.*]

[111] **Mr Lloyd Jones:** No, but regulating behaviour is an interesting concept, because we all choose to do things for many complex reasons, partly because they are to our benefit,



partly because there is a material gain to be made, and partly because it is what we should be doing.

[112] **Mick Bates:** Notwithstanding the psychology of this, time and again, you have referred to the advisory role, to Farming Connect and how we need to change behaviour. How do you think we could achieve your integrated work, and how must Farming Connect change to achieve that outcome?

[113] **Mr Pawson:** One tool that Farming Connect has at its disposal is not just the development centres but the demonstration farms. I do not know to what extent the issues that we are discussing today are a component of what development centres are promoting and whether demonstration farms are gathering and transferring that information along the chain. I am not convinced that these things are being dealt with to any major extent within the Farming Connect process currently, but it is a tool that could be used in that way.

[114] **Mick Bates:** So, are you saying that Wales should develop low-carbon demonstration farming?

[115] **Mr Pawson:** I would think that you use your existing demonstration farms and development centres to demonstrate how you make progress towards low-carbon farming; otherwise you end up with a low-carbon farming approach over here and everyone over there having a high-carbon farming approach. The key is to ensure that everyone demonstrates how they make progress towards the target.

[116] **Lorraine Barrett:** In your submission, you discuss carbon losses in dissolved organic carbon and multiple damaging effects in drained catchments. What more could be done to engage the utility companies and involve them in efforts to manage the land-based carbon stores?

[117] **Mr Pawson:** I mentioned earlier that utility companies have the opportunity to use the periodic price review of water to go to Ofwat and build the finance required to improve land management practices into their business plans. That means that you have solved the problems at the beginning rather than at the end of the pipe. Quite a few water companies are already doing that. United Utilities is doing it on a fairly large scale in Lancashire. Another company is also doing it in the Peak District, but I cannot remember its name. Quite a few of the references that we have provided give examples of those water companies. You incentivise them even more by pointing out continuously how much the clean-up is costing them.

[118] **Mick Bates:** Thank you. There are no further questions. I thank you for your answers today and for your written paper; as you say, those references are particularly important. We will look in more detail at the New Zealand model, because it may be that the Government's ability to have its own trading scheme under the climate change Act will form an important part of our recommendations. A transcript will be sent to you and, if there is any further information that you think will be relevant to this discussion, do not hesitate to send it.

[119] **Mr Pawson:** Thank you.

[120] **Mr Lloyd Jones:** Thank you.

*Gohiriwyd y cyfarfod rhwng 9.58 a.m. ac 10.01 a.m.  
The meeting adjourned between 9.58 a.m. and 10.01 a.m.*

[121] **Mick Bates:** Thank you. I see that you are all secure in your seats. I welcome you all to the second half of the scrutiny session. We will be finishing within the hour, by about 11

a.m.. It is a great pleasure to welcome all of you here this morning, from the Royal Society for the Protection of Birds, the Institute of Biological, Environmental and Rural Sciences, the Forestry Commission and the National Trust. We have received your written evidence and, in this session, Members will be questioning you on how we can reduce carbon emissions from land management in Wales. I will start with Hannah, and ask you to introduce yourselves for the Record and make a very brief opening statement.

[122] **Ms Pitt:** I am Hannah Pitt from the National Trust Wales. I will start by thanking you for the opportunity to give evidence today. This is an issue that we have significant interest in, as a major landowner in Wales. As an organisation, we have been trying to build a picture of how our operations and activities contribute to the UK's greenhouse gas emissions. Although we are far from having a clear picture on that, the initial findings indicate that agriculture is one of the largest contributors across everything that we do. The evidence that we have submitted to you focuses on carbon in the land, because we feel that it has often been a neglected part of the climate change picture, yet it has a significant role to play. Also, we feel that it presents unique challenges and opportunities that are slightly different from the things that you have been looking at in the rest of your inquiry. It is also very different because it has the potential to sequester and store carbon, which is something that other sectors do not have the opportunity to do.

[123] I should definitely stress that we are not just talking about carbon emissions when we are looking at land, because there are other greenhouse gas emissions involved. We need to look at the balance between those, because some quite complicated processes occur. The first challenge that I would like to highlight is that we do not yet have an accurate picture of the emissions from land use and agriculture in the UK or in Wales, so we certainly need to gather better information and monitor the impact of changes on the emissions that we currently have.

[124] How does land management need to change? First, we need to look at improving the way in which we manage soil. There is a massive amount of carbon locked up in Welsh soils and we want to keep it there. It is also important to highlight that the processes of climate change are a threat to soil; we are likely to see increased emissions from the soil, so it is important to put good insurance in place so that we can prevent future emissions. In this case, peat, which is very carbon rich, is a particularly important factor. Restoring peat is likely to reduce greenhouse gas emissions over time and improve its resilience to climate change, and it also brings other benefits, which are important to mention, for water, biodiversity, landscape and flood risk.

[125] In the Migneint in upper Conwy, that is the way that we are approaching the issue. We are looking at a range of factors with the tenant farmers there—everything from improving the way that they manage their farm practice to installing sheep's wool insulation in their houses. It is about looking at the whole picture. There is a considerable amount of activity and debate on the issue of peat restoration and all sorts of research is coming out. It is important that we look at co-ordinating this research and try to get an agreed understanding, because if we cannot understand the issues, as so called experts and scientists, how can you expect a farmer to understand and to know what to do on the ground?

[126] **Mick Bates:** As long as you all agree, of course.

[127] **Ms Pitt:** Absolutely; that is the first step.

[128] To encourage farmers and land managers to do what we want them to do to reduce emissions, we suggest a three-pronged approach. First, we want to look at regulations, such as cross-compliance and other controls that are already in place, to make sure that they target carbon conservation. It is worth mentioning that it can take 100 years or more for the land to produce just 1cm of new soil. In that context, it is essentially a non-renewable resource,

although it is probably not regarded as such at present. That is why we argue that it deserves the same degree of protection as water, biodiversity and air quality at the EU level. Regulation is the first part of the picture.

[129] The second part is advice, which you were just discussing with CCW. Farming Connect, training and skills development all have a role to play in encouraging farmers to do the right thing.

[130] The third part of the picture is incentives and financial rewards. The common agricultural policy is moving in the direction of rewarding public good, such as carbon management, and we hope that the current review of agri-environment schemes in Wales will also introduce these objectives. We feel that there is a need for additional funding, however, particularly for some of the more expensive restoration work on heavily degraded peat. This could come from water companies by investing to reduce problems downstream. Also, carbon markets are developing, and we need to look at what role these might play. There is some way to go in this regard, as carbon markets are not quite ready to help yet. However, Natural England's recent report shows that none of the hurdles is insurmountable.

[131] **Mick Bates:** Could you bring your presentation to a close, please?

[132] **Ms Pitt:** Yes. I will just conclude by adding that it is worth noting that some success has been achieved to date, but the tools at the Welsh Assembly Government's disposal could be used more to target this issue.

[133] **Mick Bates:** Thank you. Clive, please introduce yourself and make brief opening remarks.

[134] **Mr Thomas:** I am Clive Thomas from the Forestry Commission. Our interest in this matter is as policy adviser on forestry policy to the Minister as the manager of a large public forest estate in Wales and also as the regulator and manager of the grant scheme.

[135] To put our submission into context, the primary issue for Welsh forestry in relation to climate change is that of adaptation to ensure the long-term health and resilience of Wales's forests. Beyond that, the forests can play a worthwhile, albeit small, mitigation role, and not just as a sink for sequestered carbon on the standing trees, but also, as noted in the main evidence in our submission, in the form of substitution. The idea is that harvested wood products can be taken out of the forests and continue to act as a carbon sink in the form of construction materials as an indirect substitute for steel, aluminium and concrete where appropriate. Direct substitution is the substitution of wood fuel for fossil fuels. The committee has received a submission from us about the wood energy business scheme that we run on behalf of the Welsh Assembly Government. We think it important to broaden the notion of forestry's contribution beyond the role of carbon sink, to encompass the potential for substitution.

[136] Within that, we need to recognise that home-grown timber is a finite resource. There is no way that Wales will ever be self-sufficient in timber or fibre, so we need to view it as a precious resource and we need to put it to the best long-term uses in the substitution equation. Ideally, we would be growing as much high-quality timber as possible so that we could lock up carbon in the long term in buildings and other long-term uses.

[137] Finally, Hannah introduced the issue of soil carbon, and that is important. Most Welsh forests are on the organo-mineral soils of Wales, although some are on deep peats. Our research agency is involved in important research into operational practice in managing the carbon equation with regard to carbon sequestration and substitution benefits vis-à-vis the operational impact on the soil at the time of the operations.

[138] **Mick Bates:** Thank you, Clive. Mervyn, please introduce yourself and make a brief opening statement.

10.10 a.m.

[139] **Professor Humphreys:** Thank you for this opportunity to talk to you this morning. The Institute of Biological, Environmental and Rural Sciences is part of Aberystwyth University, and we conduct basic research on fundamental problems in agriculture, sustainable land use, food production, bioenergy, nutrition and health. This applies to the area that we are discussing on carbon reduction and land use.

[140] We translate fundamental plant science—in this context, it is plant science in relation to carbon fixation, carbon resource allocation in plants and carbon utilisation—into plant breeding and new crop varieties. We also carry out underpinning research on parasitology and gut microbiology to deliver new systems for sustainable animal production. We have done recent work on translating plant science and microbiology into second-generation bioenergy crops, and we are also doing work on linking fundamental biology with earth observation and spatial modelling. Many of the crops that we work with are perennials, and perenniality is a key process in carbon sequestration. We carry out work on grassland improvement for food production and ecosystem services. Our last round of funding from the Department for Environment, Food and Rural Affairs heavily emphasised the ecosystem services side of the work, but I am pleased to see that food production has come back up the agenda more recently.

[141] There are win-win situations; for example, our high-sugar grasses reduce nitrogen pollution, increase production and also provide a biorenewable resource for bioenergy and the production of platform chemicals, such as ethanol, butanol and succinic acid. The work on *Miscanthus* is to look at the potential to provide a lignocellulose feedstock for combustion and fermentation. Our work on rumen fermentation seeks to reduce methane emissions, and the work on the rumen microbe flora can also be taken out of the animal and used in industrial fermentation for a very wide range of wastes.

[142] **Mick Bates:** Thank you. I note your comments about food production, which has fallen by 15 per cent over the last 10 years in the UK. Finally, we turn to the RSPB.

[143] **Mr Davies:** I am Jeff Davies, agricultural and rural policy officer for RSPB Cymru. On my left is Jared Wilson, who manages the LIFE blanket bog restoration project at Lake Vyrnwy. Thank you for the opportunity to present evidence. The RSPB recognises the importance of land management and carbon emissions in the context of climate change, and the urgency of the need to reduce carbon emissions. We also recognise the inter-connection between the management of carbon-rich soils, water management and biodiversity. Our upland peat lands, mainly blanket bog, are a huge store of carbon and are among the most important wildlife habitats in Wales. Much of that habitat is in a degraded state, and we see its restoration as a priority. However, there are benefits for water, archaeology and carbon protection, and we believe that an integrated approach along with rigorous scientific monitoring of the process and outcomes is the way forward.

[144] Protection of the carbon store is paramount, but how can that be achieved? The vast majority of the uplands are farmed, and we believe that cross-compliance through the CAP payment system should play an important part in the first line of defence. Many of the basic issues relating to sustainable management of soils are already covered by cross-compliance. At the next level, where proactive management is needed, such as blocking old drainage ditches to restore water levels, the suite of measures available under axis 2 of the rural development plan should be used, and the Welsh Assembly Government is considering such

measures in its current review of axis 2 schemes. We see this as a positive move.

[145] Above all, we think that the current review of land management schemes in Wales provides a golden opportunity for real integrated management of the Welsh uplands.

[146] **Mick Bates:** Thank you, Jeff. We now move to questions, and Rhodri Glyn has the first question to the National Trust.

[147] **Rhodri Glyn Thomas:** Mae'r cwestiwn yn benodol i'r Ymddiriedolaeth Genedlaethol, ond byddwn yn gwerthfawrogi sylwadau oddi wrth y tystion eraill os oes ganddynt farn ar hyn. Mae Jeff newydd gyfeirio'n rhannol at hyn, sef bod tystiolaeth yr Ymddiriedolaeth Genedlaethol yn dweud nad oes gennym y darlun mawr o ran allyriadau carbon o ddefnydd amaethyddol o'r tir. Trafodasom yn eithaf manwl gyda'r cyngor cefn gwlad sut yn union yr ydym yn cael adroddiadau ar hyn yn ôl. Awgrym y cyngor oedd ein bod yn defnyddio cynlluniau amaeth-amgylcheddol, a fyddai'n golygu mai dim ond canran cymharol fach o ffermydd a fyddai'n adrodd yn ôl dan y system honno. Byddwn yn awgrymu mai math arbennig o amaethwyr a fyddai'n gwneud hynny: y math o amaethwyr sydd wedi dangos bod ganddynt ddiddordeb yn yr effaith y mae amaeth yn ei gael ar yr amgylchedd wrth wneud cais am fynediad i'r cynlluniau hynny yn y lle cyntaf. Cyfeiriodd Jeff at y taliadau polisi amaethyddol cyffredin a'r modd y gallem weithredu drwyddynt. A oes gennych yr ateb i'r broblem hon? Heb y data sylfaenol hynny, bydd yn anodd gweithredu'n effeithiol yn y maes hwn.

**Rhodri Glyn Thomas:** The question is specifically to the National Trust, but I would appreciate comments from the other witnesses if they have a view on this. Jeff has just alluded to this in part. That is, the National Trust's evidence states that we do not have the big picture in terms of carbon emissions from agricultural use of the land. We discussed in some detail with the countryside council how exactly this is reported back to us. Its suggestion was that we used the agri-environment schemes, which would mean that only a comparatively small percentage of farmers would report back under that system. I would suggest that that would be a particular type of farmer: the type of farmer who has already shown an interest in agriculture's impact on the environment in applying for entry to those schemes in the first place. Jeff referred to the CAP payments, and the way in which we could operate through them. Do you have the solution to this problem? Without that basic data, it will be difficult to act effectively in this field.

[148] **Ms Pitt:** It is probably worth starting by explaining why we say that we do not have the complete picture. It is partly because the reporting method that the UK uses under the Kyoto protocol does not take into account all aspects of what is known as the land use, land-use change and forestry bunch of greenhouse gas emissions. It does not take account of the whole picture, so, for example, deforestation that is not on Forestry Commission land is not necessarily being taken into account. So, the first issue is that the UK has chosen which bits are practical to report on, which does not take account of the whole picture. There is a particular issue around peat, and, again, this comes out of Natural England's report. It looks like its estimation for the contribution from peat to greenhouse gas emissions is a significant underestimate, partly because we do not know the full extent of the degradation, particularly in Wales; we do not know how much of the peat has degraded. So, there is a basic issue around what is being counted and what information we are seeking.

[149] In terms of getting the information from farmers, I do not think that it will be a particularly easy thing to do, I will be honest about that—

[150] **Mick Bates:** We welcome honesty.

[151] **Ms Pitt:** There are things such as the carbon accounting for land managers tool, which was developed by the Country Land and Business Association, which we used when we tried to understand the emissions of our organisation, so there are things out there that will help. I am sure that there will be an issue about promoting tools such as that to individual farmers, in terms of whether they will be able to understand them and whether they will be motivated to take part. They will have to see a benefit from doing so. Agri-environment scheme monitoring will need to play a part. If we are going to include carbon objectives in the schemes, there will need to be monitoring. There is no question about that. Beyond that, I do not have the answer as to how you reach all those farmers. It needs some thought.

[152] **Mick Bates:** Do any other witnesses wish to comment on that? One point that I noted was that you said that only Forestry Commission deforestation was taken into account, so, presumably, Clive, private forestry does not form part of those carbon figures.

[153] **Mr Thomas:** If I am correct, it is not so much the ownership as the timing. There is a baseline year in the inventory that Hannah referred to, and I think that it is 1920. Any woodland that predates 1920 is assumed to be in equilibrium, so, in terms of the sequestration that goes on in those trees, the losses through decay and the releases from the trees is in equilibrium. The biggest point in terms of that inventory, from our point of view, is that some of those woodlands are being managed, so harvested wood products are being taken out of them and are contributing towards emissions reduction. I would agree with Hannah that there is a big issue around the land use, land-use change and forestry inventory methodology. I do not think that the biggest issue is about deforestation, because forestry is well regulated in Wales and deforestation has been minimal, and has been for the right reasons, namely biodiversity gain, by and large.

[154] **Mick Bates:** Mervyn, do you have any comments on these figures and the data? You point out the importance of perennality with your Miscanthus example.

10.20 a.m.

[155] **Professor Humphreys:** The bottom line is that we need more data on what happens in some of the systems and on how much carbon is going in, where it is going and what happens to it after long periods of time.

[156] **Rhodri Glyn Thomas:** The question is how you present that data. We have not really agreed that we need more data, but how would you collect and collate it?

[157] **Professor Humphreys:** Clearly, the land managers have to come into that. It involves the farmers, the forestry people, the people who look after water quality, and the people who make use of the products from the land. Therefore, in terms of the energy crops, it involves the people who make use of the feedstocks. Therefore, we have to collect data from all parts of the process.

[158] **Mr Wilson:** One of the issues with some of the systems is that because we do not really understand the processes that are underlying the carbon or greenhouse gas flux, it is very difficult to come up with a list of things that we should be measuring. Until we have a better understanding of those processes, just coming up with a suite of things to measure might not actually tell us what we want to know. Therefore, the first step is to identify what we are interested in. There are still such big knowledge gaps for a lot of the ecosystems that we are not in a position to do that at present.

[159] **Mick Bates:** You have the LIFE programme on the Vyrnwy estate. How long will it be before you have that type of evidence available to help the Government to decide where best to target its resources in order to reduce carbon?

[160] **Mr Wilson:** The research work at Lake Vyrnwy is being carried out by the UK Population Biology Network, UKPopNet; it is not being carried out by the LIFE project. It is talking about it being another two years before it really gets enough data. It has two years of data thus far, and it thinks that it needs another year or two years. I think that the general view across the United Kingdom is that you need at least five years' worth of data from an individual site in order to say anything meaningful about that site. It is not actually much use knowing what is going on at one site unless you can apply that across a much larger landscape. One of the objectives of the work that UKPopNet is doing at Lake Vyrnwy is to produce a generic model that can be applied much further afield. It is all well and good to know what is happening at Lake Vyrnwy but it is a very small part of Wales and it is just one system.

[161] **Mick Bates:** Nevertheless, in another two years you will have evidence. Will that then enable us to have a generic model that goes across all similar habitats in Wales?

[162] **Mr Wilson:** That is a good question. [*Laughter.*]

[163] **Mick Bates:** Will it?

[164] **Mr Wilson:** If you ask the scientist, I think that he will always want some extra money for some extra research.

[165] **Mick Bates:** We will ask Merv about that.

[166] **Mr Wilson:** One of the things that we are very keen within the RSPB and the LIFE project partners is to pursue a model that takes the best evidence to date and is not perpetually waiting for the next publication. Our hope is that, within a couple of years, we will have a much better understanding of the processes and the results of some of the restoration work that we are doing. That does not answer your question, does it not?

[167] **Mick Bates:** No. I think that we are all getting slightly impatient. We know about this issue of data. I was looking at Merv; I would assume that somewhere someone has done the research to tell us how much carbon is locked up over what period of time. I think that someone referred to the sigmoid curve of carbon take-up. Presumably, there are general figures available to assist us in our recommendations to the Government about how it can target funds effectively to make sure that it gets the biggest bang for its bucks when it comes to looking at how we can reduce carbon from land management. Is that type of research—

[168] **Professor Humphreys:** There is basic data. The problem is that it is a very complex situation. The models that can make use of that data are improving and can provide some answers. Within certain limitations they can provide some generic answers. Very often, the application of particular management techniques is very specific. In a way, you need to model every specific situation but having the models there and some basic data should allow that.

[169] **Mick Bates:** We cannot have 17,000 different models.

[170] **Professor Humphreys:** It would be the same model but applied in 17,000 situations.

[171] **Mick Bates:** The same model could be applied across 17,000 different situations. Is that what you are saying?

[172] **Professor Humphreys:** Yes.

[173] **Mick Bates:** Do you agree with that, Jared?

[174] **Mr Wilson:** Yes, if the model works.

[175] **Mick Bates:** If the model works, I see. [*Laughter.*] Does anyone have this model?

[176] **Mr Thomas:** We do not have it, but I can describe the process that is going on for the woodland area. We have a good inventory called the national inventory of woodland and trees, which maps woodland down to half a hectare. A sample survey is then done, going out to the woodland and looking at its characteristics. Through that statistical process, you can build up an accurate picture of what we call the 'growing stocks', that is, the standing biomass. You can then link that to a model that Forest Research has developed, which is called the CARBINE model, and it is now looking to link that to the soil model, so that you can get the whole dynamic, with the soil model and the above-ground biomass model. I do not know whether or not that is possible to replicate in agriculture, but that is the process that is currently going on within forestry. That will feed directly into the land use, land-use change and forestry inventory in the future. Whether or not through the post-Kyoto negotiations all of the different aspects of forestry get captured within the inventory is another matter, because forestry is basically excluded from the protocol at the moment.

[177] **Mick Bates:** Why is forestry excluded?

[178] **Mr Thomas:** It was a matter of contention internationally in relation to deforestation in the tropics at the last Kyoto round, so the whole harvested wood products issue was excluded from the Kyoto protocol. That is one of the things that it is hoped to introduce for the Copenhagen round.

[179] **Rhodri Glyn Thomas:** It seems, Chair, that, after an hour and a half of deliberation, we now find that there may be a model that could work in 17,000 different ways. We just need to find someone who knows what the model is, or someone who knows someone who knows what the model is, and then we can begin the process of collecting the data.

[180] **Mick Bates:** There endeth the first lesson. [*Laughter.*]

[181] You can obviously see our confusion here. We all want the data and there is an urgency about implementing whatever the Government can do to reduce carbon emissions, but we are still talking in terms of years before we even have an agreed model. I do not think that there is any need for comment on that. Darren is next.

[182] **Darren Millar:** To follow up on that, we were all impressed with what was going on in terms of the biodiversity and the water improvement stuff taking place at Lake Vyrnwy, but it was not clear what the actual benefit was in carbon sequestration from the atmosphere. Earlier on, we took some evidence from the Countryside Council for Wales, which made it clear that of the 11 per cent of greenhouse gas emissions that come from agriculture, land management and forestry in Wales, only 2 per cent is carbon dioxide emissions or carbon emissions. I just wonder whether we are focusing, perhaps, on the wrong end of the spectrum here. We are focusing every bit of attention on carbon and perhaps ignoring the bigger issue, which is the nitrous oxide and the methane emissions. What are the panel's views on, perhaps, guiding us to pay more attention to dealing with that problem, rather than the carbon issue, given the lack of data that we have already talked about? Mervyn, we heard earlier about high-sugar grasses, for example, and their ability to reduce the methane and ammonia emitted from cattle and other livestock grazing on them. Is that a better way forward, rather than us talking about planting more trees on certain types of land, which, of course, is a bit easier to measure, or doing more stuff on the blanket bogs, albeit that there are biodiversity benefits and other benefits?



[183] **Professor Humphreys:** It is part of the equation. Methane is a carbon emission; it is a carbon compound. The nitrogen pollutants, nitrous oxide and ammonia, need to be taken into account when looking at the overall system. So, yes, it is wrong to single out one component of the system and concentrate on that without having due regard to other things. As you mentioned, high-sugar grasses manage to cover both areas in terms of carbon and nitrogen emissions, and we can possibly look for other things like that.

10.30 a.m.

[184] As we understand more about what goes on in the rumen of the animals, we can understand more about how to control emissions, in terms of the methane as well as what happens to the protein and the breakdown products, which are nitrogen compounds, in the animal. Dietary factors, including supplements, can affect that, but there is a complex ecosystem within the rumen of the animal, and we are only beginning to understand some of the processes involved in that.

[185] **Darren Millar:** We are trying to establish what we can recommend to the Welsh Assembly Government in order to assist in reducing carbon emissions from the land in Wales. However, it is not clear that we will be able to measure any of these potential outcomes, and that is the difficulty. It is relatively straightforward to measure outcomes in livestock by changing the feeds and so on, so I wonder whether that is the more appropriate way for us to go forward—reducing greenhouse emissions rather than carbon emissions from land-based activities.

[186] **Professor Humphreys:** I think that it is very difficult to be sure what your ultimate objective is. If the whole purpose is to reduce carbon emissions, you would do something quite drastic and forget about food production and agriculture. If you want to maintain food production—and there are strong arguments that we do so—you must accept that there will be some consequences of having livestock on land. We want to mitigate those consequences as much as possible, but they cannot be eradicated; if you take livestock off the land altogether, you could do more about increasing carbon sequestration and reducing nitrogen pollutants, but I do not think that that is the ultimate objective.

[187] **Mick Bates:** We have three big land managers here. Coming back to Hannah, you manage farms as well. How do you approach this little dilemma that we have about reducing carbon production?

[188] **Ms Pitt:** To comment on the previous question, we need to look at all of the greenhouse gases from all sources in the sector. However, it is important to remember that the difference with land-based carbon stores is that they will be affected by climate change, so there is a certain degree of action needed to keep ticking over with the level of greenhouse gas emissions that we have at the moment. There will be increases if we do not improve the management of the soil. That is the first point.

[189] On the question of food, we are not talking about choosing between doing this or producing food; what we need is a way to integrate the objectives so that you produce food in a sustainable way. Again, it is important to remember that, if we want to produce food in future, we need soil, water and everything else. Taking a long-term view, if we are to be able to continue producing food, we need to think about managing the land sustainably now.

[190] **Darren Millar:** You have all referred in your papers to the need to use the axis 2 reforms of the CAP as an opportunity to look at how agriculture in particular can contribute to saving the carbon in Welsh land. However, I am not sure that you have come up with any practical way of doing that. There is some clear evidence, which you kindly made available to

us, on how to help to reduce wider greenhouse gas emissions, but there is nothing for carbon. It is a bit like the quest for the Holy Grail, and I wonder whether we will ever be able to manage this properly and establish some data so that we can make a judgment about what is reliable and introduce something on the peat bogs, for example, which is the only promising area. From what you are saying, Jared, we will not have any data on that either for another couple of years at least.

[191] **Mr Wilson:** Yes. One guiding principle is that more than 90 per cent of the blanket bog or peat bog restoration that has been carried out across the UK has been done for biodiversity gains. That is where the funding has come from. Virtually all of the organisations that have carried out that work perceive that they have also had carbon gains, and they think that because it is blanket bog habitat that has produced those 8m of peat underneath. So, if you get that ecosystem functioning again, you have a very good chance of at least keeping that peat and carbon there and, potentially, in the future, sequestering it. So, that is the underlying principle that is guiding most of the restoration work that is seen as having a benefit in terms of carbon too.

[192] **Mick Bates:** Do you want to come in on this, Lorraine?

[193] **Lorraine Barrett:** Yes. I am sorry that I had to pop out of the meeting then. My question is mainly for the RSPB, but others may want to come in too. In your submission, you raise concerns regarding the evidence base for carbon restoration activities. Could you say a bit more about that?

[194] **Mr Wilson:** One of the reasons for this uncertainty is that, in the past, a great deal of the focus has been on carbon dioxide and, to some degree, ignored methane, which poses a much more complicated question and is a much more volatile gas. It is only in the past few years that it has had a bit more attention. Many of the studies done to date have been on a very small scale, both geographically and temporally. They have mainly produced carbon dioxide figures, and a generic methane figure has then been put on top of that. So, the estimates that have been produced may not be as good as people may have thought in the past.

[195] Some of the work being done at Lake Vyrnwy at the moment has been measuring methane at different scales—dinner-plate scale, a 5m scale and a slightly larger scale—and the researchers are getting different measurements depending on which scale they measure at. One of the reasons for that is that there is a great deal of variation in the landscape; there might be little hot spots where there are very high methane emissions and, if you take samples over a small area, you might miss those or find only those. That is one of the reasons why there is this uncertainty, and I get the impression that, over the past six months to a year, more and more research groups have realised that there is this uncertainty.

[196] **Lorraine Barrett:** How practical will it be to do this research on a scale that is big enough to give us something substantial?

[197] **Mr Wilson:** We have set up an experiment at Lake Vyrnwy. One of the big projects there is a scaling-up project called Bug-to-Big. The guys there have taken a section of peat to London and they are looking at how different water tables and different temperatures affect the soil organisms and the gases that they produce or take in. They are also doing these field experiments at a number of scales, and they are scaling up beyond the hectare scale, using an experimental aircraft that flies over and takes gas samples. So, their drive is to do this scaling up so that they know the appropriate scale to measure at at a site and how that can be scaled up to give you a good estimate.

[198] **Lorraine Barrett:** Is that being done anywhere else in Wales? Can it be done

anywhere in Wales, and does it need to be done anywhere else?

[199] **Mr Wilson:** The fieldwork is just being done at Lake Vyrnwy, and the model is being produced at Vyrnwy, but that model will be tested at other sites, including, I think, National Trust land on the Migneint just to the north; discussions are taking place with other landowners too. The aim is to use this model, test it on a few other sites and ensure that it is robust so that it can be applicable across the uplands of the UK and who knows where else?

[200] **Mick Bates:** How many years are we talking about?

[201] **Mr Wilson:** It will be a couple of years.

[202] **Mick Bates:** So, you are sticking to two years.

[203] **Mr Wilson:** Yes.

[204] **Mick Bates:** Hannah, do you want to contribute on this?

[205] **Ms Pitt:** It was mentioned that a significant amount of work has taken place in the Peak District. I think that that work is slightly further down the line than that at Lake Vyrnwy. The people doing that work have at least five years of data, which seems to be the crucial factor. They are now getting to the stage where they are able to model the impact of changes in land management on the greenhouse gas picture.

10.40 a.m.

[206] That includes dissolved organic carbon and methane, so it is the whole package. One of the interesting things that that shows is that a great deal of the focus of peat restoration has been on making it wetter, and that seems to be where you get the methane problem. However, other techniques such as planting and revegetation do not seem to have such a significant impact on the methane. So, you seem to have a better overall impact on greenhouse gas emissions. That model is fairly well developed and may be available for wider application soon.

[207] **Mick Bates:** I think that we will have to look in more detail at that evidence. What is it called?

[208] **Ms Pitt:** Moors for the Future is the partnership.

[209] **Mr Wilson:** That is the model that has been developed by Durham University. There are a couple of points to make about it. A large part of Moors for the Future's project area, the Peak District National Park, is bare peat, and they are revegetating it with rye grass and upland plant species. Whether that model is applicable to the uplands of Wales, where, generally, there is not a large amount of bare peat, is unknown. A great deal of that work has been on a small scale. So, there are still question marks.

[210] **Mick Bates:** We are getting all academic and technical on this one. Let us get back to reality.

[211] **Leanne Wood:** I have some questions for the Forestry Commission. You say in your submission that Welsh forests and forestry can have a small but not insignificant role to play in helping to reduce Welsh carbon emissions. You also say that dramatic increases in woodland areas will not make a major contribution to a reduction in emissions. Can you explain the role that you have and tell us what the Welsh Assembly Government is doing to help you to fulfil your role?

[212] **Mr Thomas:** The reason that we say that it is small but not insignificant is that that is the reality, based on the total UK, or Wales, emissions levels. You would have to plant the whole of Wales to make any inroads there. We understand that there is competition for land and there are other services and products that we all need from that land. So, that is not the suggestion. I am not sure whether the thrust of our paper is relevant to this committee, because you are focusing on emissions from the land itself whereas the focus of the paper is the role that harvested wood products can play in reducing the overall emissions for Wales through substitution. That is much more about managing the woodlands, rather than having lots more of them. Roughly 50 per cent of Wales's woodlands are managed. One of the most intractable forestry policy issues is how to bring more woodland into management, because the woodland that is not managed tends to be fragmented, is mostly on farms and does not tend to be viewed as a valuable resource. We are hopeful that the wood fuel market can be the catalyst to begin to manage more of those woodlands—not all of them necessarily, because some of them should probably not be managed from a biodiversity point of view. Certainly, a much bigger proportion of those woodlands could be contributing to emissions reductions and addressing energy poverty—given the cost of fuel at the moment—if they were brought into management.

[213] So, we are currently working as policy advisers on behalf of the Minister in relation to revising the woodland strategy in Wales. As I said in my introductory remarks, one of the main thrusts is about diversifying Wales's woodlands to make them more fit for purpose and resilient for the future—not just from a climate change adaptation point of view, but to deliver a wider range of environmental and social benefits that we were working on long before climate change came into the discussion. The paradox there is that, through that diversification, the overall productivity of Wales's woodlands could go down in relation to the carbon balance, because we will be sub-optimising in species terms. So, some of the more productive species will be replaced by native species, which grow more slowly and lock up less carbon. That is still exactly the right thing to do, but the strategies for managing the issue are to have a modest increase in woodland cover. We believe that the axis 2 review offers some scope for that. If you look at the outcomes that are sought in axis 2, you will see that trees and woodlands are among the solutions, along with modified agriculture. So, there is a choice.

[214] The other key issue is bringing more of those woodlands into management and finding the policy levers to do that. The fact that 19,000 ha of woodland is already mapped on Tir Gofal farms makes that an obvious place to start. The fact that farmers have expressed an interest at least in an agri-environment scheme and in their woodlands by having them mapped within a Tir Gofal scheme does not mean that they are currently managed, so we would go looking there to increase the management. So, on creating the framework within the woodland strategy to do that, some of the axis 2 funding will hopefully be one way of making it happen.

[215] **Leanne Wood:** So, for our recommendations, you would say that, rather than expanding the existing woodlands, we should prioritise managing existing woodlands better, to harvest as much products for fuel, and to get better gains, or hits, quicker.

[216] **Mr Thomas:** If you are focusing on carbon emissions, there are many other good reasons for making a modest increase in woodland cover. One such benefit would be carbon reduction in the longer term, through sequestration and, if managed, through harvested wood products. However, the whole concept of multipurpose forestry would suggest that we should not just have carbon forestry; we had a single-purpose objective 80 years ago, and that is why we now need to adapt those forests, because they were being managed for a single purpose rather than multiple purposes. So, there are powerful arguments for having more community woodlands and more woodland biodiversity to deal with some of this fragmentation.

However, the overall productivity of Wales is in woodlands, so I would diversify what we have by making modest increases in woodland cover to replace some of that productivity. It is about finding a balance of recommendations, rather than prioritising one.

[217] **Mick Bates:** I have a question before I call Lesley to ask questions to the RSPB. Am I right in assuming that planting any species of tree in any condition helps to reduce carbon in the atmosphere?

[218] **Mr Thomas:** Trees that are planted will sequester carbon.

[219] **Mick Bates:** So, if we had a menu, like that under the woodland grant scheme, would it be possible to say which species gives the quickest sequestration of carbon per hectare?

[220] **Mr Thomas:** Yes.

[221] **Mick Bates:** Is that Sitka spruce, or something like that?

[222] **Mr Thomas:** It depends on the site. If you were growing in a short-rotation coppice system—and I am looking at Mervyn here—some of the willows would sequester carbon much faster than Sitka spruce.

[223] **Mick Bates:** What about Miscanthus?

[224] **Professor Humphreys:** Yes, that is quick at fixing carbon as well; it is a tropical grass, which is efficient at fixing carbon. There is a constant dilemma here: if a farmer has a field, he can sow maize or plant Miscanthus. They are both tropical species, and they both fix carbon effectively. One is a perennial species, and the other is an annual species. One is used for food production, and the other for energy production. That focuses the dilemma in a way, in understanding what land management is about. It is part of a whole process and life cycle, and we need to understand that.

[225] **Mr Thomas:** I think that Mervyn would agree that, because sequestration is sigmoid and, eventually, this equilibrium—

[226] **Mick Bates:** This ‘sigmoid’ is mentioned in your paper, is it?

[227] **Mr Thomas:** Yes. That is the substitution issue, whether it is through short-rotation coppice, or through harvested wood products. That is a cumulative impact. You get that every time you go in, then the biomass is on the site, and the rate of sequestration increases again to lock in more carbon to replace the carbon that you have taken out and used for substitution. We have included graphs in our paper to try to illustrate that point.

[228] **Mick Bates:** Hence the carbon density concept.

[229] **Mr Thomas:** That is right.

10.50 a.m.

[230] **Rhodri Glyn Thomas:** CCW told us earlier that the important thing in carbon sequestration is that you plant the right kinds of trees in the right places. Are you confident that you are planting the right trees in the right places?

[231] **Mr Thomas:** I am confident that we are. I am not confident that we always have planted the right trees in the right places, but I think that since forestry policy was devolved—

- [232] **Rhodri Glyn Thomas:** It is a major achievement under devolution then, is it?
- [233] **Mr Thomas:** Yes, I think so, personally. We have more responsibility for forestry policy now.
- [234] **Lesley Griffiths:** On the protection of soil carbon, in your paper, you speak about good practice and people not undertaking damaging activities. Could you tell us whether you think that the current regulatory safeguards are sufficient to ensure the protection of soil carbon, such as the conditions under the cross-compliance regime?
- [235] **Mr Davies:** The current cross-compliance requirements, which are partly regulatory and partly good practice—that is, they are part of the good agricultural and environmental conditions requirements—are quite broad. If they are followed and enforced properly, we think that they do the job of protecting soil from further degradation or erosion and therefore the consequent loss of carbon from soils. It is a matter of ensuring that farmers are aware of what is required of them, and of ensuring that such conditions are enforced.
- [236] **Mick Bates:** I found the Institute for Biological, Environmental and Rural Sciences paper interesting because you gave us a direction on carbon savings per hectare across various crops. One of the most interesting phrases in that paper, in reference to bio-energy, was ‘stabilisation wedge’. Could you explain that term and put it in the context of assisting with carbon reduction?
- [237] **Professor Humphreys:** It is something that you can do relatively quickly. It will have a rapid impact on carbon sequestration because these things grow quickly. Therefore, it can be a quick fix, in a way, as far as increasing carbon sequestration is concerned. That is what I mean by a ‘stabilisation wedge’.
- [238] **Mick Bates:** So, a ‘stabilisation wedge’, which is a lovely term, is a quick fix.
- [239] **Professor Humphreys:** Yes, basically.
- [240] **Mick Bates:** How quickly are quick fixes and the things that you produced in your paper achievable?
- [241] **Professor Humphreys:** Miscanthus takes a year to establish and then, after that, is fully productive for 50 years, as far as we know.
- [242] **Mick Bates:** Miscanthus gives a good abatement, does it not?
- [243] **Professor Humphreys:** Yes.
- [244] **Mick Bates:** You measure it in energy terms, so it is possible to equate that with carbon, is it?
- [245] **Professor Humphreys:** Yes.
- [246] **Mick Bates:** So, I think that you said that there were around 370 kg of carbon per hectare.
- [247] **Professor Humphreys:** Yes, it is something like that.
- [248] **Mick Bates:** So, those figures are researched and are quite robust.
- [249] **Professor Humphreys:** We have strong evidence on those figures, coming back to

our models on Miscanthus. Our data on Miscanthus are robust.

[250] **Mick Bates:** Presumably, according to the physical conditions, there is a margin of error. How large would that be if you grew it in sandy soils over the border, or in heavy soils in the hills of Wales?

[251] **Professor Humphreys:** It has more to do with temperature and water availability than anything else.

[252] **Mick Bates:** So, what would be the margin of error with those two factors?

[253] **Professor Humphreys:** Depending on water availability and temperature, we would have a range within 20 per cent, I guess.

[254] **Darren Millar:** We have talked about the other benefits of managing the land in this way, and you mentioned the availability of water. There is a huge flood-mitigation issue here as well, given the land's ability to absorb water. Just as a matter of interest, which of those would be the best crop? You have mentioned willow, which everybody would associate with taking lots of water out of the ground, but is Miscanthus as good as willow?

[255] **Professor Humphreys:** Yes. It is not as demanding as willow for water in its growth, but it stabilises the soil in the same way. Grassland reduces the overland flow of water, which is important when it comes to flooding, and Miscanthus can also do that. Willow is less effective in that process.

[256] **Darren Millar:** We, as a committee, will look at flooding in the new year. Is Miscanthus one of those crops that would not fail if there were an intermittent, irregular flooding pattern on a piece of land, unlike some of the arable crops that are grown on the lower lands at the moment?

[257] **Professor Humphreys:** Due to its perennial nature, it has a very strong rhizome system and it will grow and re-grow. In its natural habitat, it grows in quite wet areas.

[258] **Darren Millar:** Thank you.

[259] **Mick Bates:** I see that there no further questions from Members and, therefore, I thank you very much for this very interesting session. However, we seem to have raised as many questions as we asked, particularly about timescales and modelling and how they can be used to assist the Government in reducing carbon emissions. A copy of the transcript will be sent to you. If there is any further information, particularly about modelling, that you think may be useful to us in our deliberations on our recommendations, it would be very welcome. On the scientific evidence for your stabilisation wedge that you have just mentioned, short-term gains may be useful to help us with our recommendations so that the One Wales Government can meet its 3 per cent annual carbon reduction target. I thank you yet again, and look forward to your reaction to our recommendations. I think that modelling will form a large part of them.

10.57 a.m.

### **Papurau i'w Nodi Papers to Note**

[260] **Mick Bates:** There is further evidence to note from the RSPB and from the Sustainable Development Commission on windfarm developments. There is also the Minister's statement on fuel poverty in Wales. Is everybody okay with those? I see that you

are.

[261] I should mention that we are having great difficulty trying to arrange another session for the Minister to attend to complete last week's work. I propose, unless there any objections, that I write to the Minister with the questions outstanding from the last session. I see that there are no objections to that proposal.

[262] This is the last meeting for the autumn term and I take this opportunity to thank you for your attendance and for your questions during this session. Our next meeting will be on Thursday, 22 January 2009, when we will complete our scrutiny of land use for our inquiry into carbon reduction.

10.58 a.m.

**Cynnig Trefniadol  
Procedural Motion**

[263] **Mick Bates:** I propose that

*the committee resolves to exclude the public from the remainder of the meeting in accordance with Standing Order No. 10.37(vi).*

[264] I see that the committee is in agreement.

*Derbyniwyd y cynnig.  
Motion carried.*

*Daeth rhan gyhoeddus y cyfarfod i ben am 10.59 a.m.  
The public part of the meeting ended at 10.59 a.m.*