All Party Parliamentary Group on Beef and Lamb

The carbon footprint of the beef cattle and sheep sector

May 2013

Contents

About the APPG on Beef and Lamb

The Beef and Lamb All-Party Parliamentary Group is a cross-party group of MPs and Peers which aims to ensure that parliamentarians are fully briefed by industry experts on the latest developments in the beef and lamb sector, including supply chains, exports, sustainability, health and nutrition.

Officers: Neil Parish MP (Chair)
Andrew George MP (Vice-chair)
Huw Irranca-Davies MP (Vice-chair)
Rory Stewart MP (Vice-chair)
Roger Williams MP (Vice-chair)
Mark Spencer MP (Vice-chair)
Baroness Gibson of Market Rasen (Secretary)

All-Party Groups are informal, cross-party, interest groups that have no official status within Parliament and are not accorded any powers or funding by it.

Weber Shandwick (a consultancy) is retained by EBLEX, the organisation for beef and lamb levy payers in England, to act as the APPG's secretariat. The views expressed in this report are solely those of the APPG.

For further information, please contact Laurence Diment on ldiment@webershandwick.com, or telephone 020 7067 0366.

Foreword

The All-Party Parliamentary Group for Beef & Lamb was created with the purpose of promoting informed debate on the British beef and lamb industry and to communicate its importance to the UK's economy and the role it will play in our food security.

One of the greatest challenges facing governments across the globe is how we feed a world population that will reach nine billion by 2050 using existing agricultural land whilst minimising our impact on the natural environment. Grazing cattle and sheep are often given disproportionate blame for carbon emissions from the agriculture sector and there is not enough recognition amongst some conservation groups of the role livestock farming, particularly grass-fed beef and lamb, plays in storing carbon, protecting biodiversity and utilising marginal land that cannot be used for arable crops but can grow very good grass.

We must examine how we produce our food and which farming systems make the most efficient use of land. However, as the evidence submitted to this inquiry demonstrates, there is little consistency in the models used to measure the carbon emissions of grazing livestock, the difference in farming systems is not taken into account and there is no consensus internationally on which models should be used. Factors such as carbon sequestration feature in the model used in France but not in the PAS 2050 model developed by Defra. Without some form of universally recognised model for measuring livestock carbon emissions there can be no real understanding of its causes, its effects and how we make food production sustainable for the future.

Cattle and sheep are very good converters of lower quality proteins from permanent pasture grassland into first-rate beef and lamb meat which has a role in feeding the world's growing population.

I would like to thank EBLEX, the organisation for beef and lamb levy payers in England, for supporting the APPG in its work and I would like to thank Weber Shandwick which provides the secretariat for the APPG for their help in compiling this report and providing the necessary staff. I would also like to thank all of those individuals and organisations who submitted written evidence and who appeared before our oral evidence sessions as well as the other Members of the APPG who took part in this inquiry.

Neil Parish MP

Executive Summary

Food security and environmental sustainability pose major threats to the global population and need to be taken very seriously indeed. As this report shows, policy needs to be designed to balance these two concerns, as well as factoring other issues such as animal welfare, healthy diets, economic viability, employment and preserving rural communities. As this demonstrates, emissions are only one part of a much bigger picture, albeit a vital one.

The environmental impact of the livestock sector, and in particular the beef and lamb industries, is well publicised. However, it is questionable whether it should be regarded as accurate. Little is said of the benefits it can provide as acting as a carbon sink and enhancing biodiversity. The debate is often couched in terms of carbon footprint yet there is concern, highlighted in this report, that the understanding of what makes up the carbon footprint of grazing livestock is not very deep at all.

It is important that we get this component right. Only when we are certain that all of the pieces of the puzzle are correct will we know what we are dealing with and how to solve it. This report shows that there are a large number of models used to assess carbon footprint which raises two crucial points. Firstly, that there is a lack of consensus on how to measure livestock's emissions; and secondly, that any debate going on at a supranational level is not based on comparable data.

The variation in data arises because of two reasons:

Firstly, there are variations that arise from different production systems. Variables such as feed system, pasture type, rearing time, genetic make-up and gut micro flora of the animal can all impact the quantity of methane emitted. The report demonstrates that there is no 'one size fits all' data set. Therefore more work needs to be done to analyse the different systems in order to get an accurate measurement.

Secondly, there is an issue surrounding variations arising from the framework used. One of the major areas of contention is the inclusion of carbon sequestration which has a major impact on the total emissions value. Bill Grayson, a producer who gave evidence to the inquiry, ran four models on his farm's emissions. One, PAS 2050 - the Defra accepted model which does not include sequestration - concluded his farm was a net emitter, whereas the other three, which do include sequestration, put his farm as a net absorber. Evidently differences of this significance make sensible policy development near impossible.

Further, there is no international consensus on sequestration. For example, while it is excluded in British assessments it is included in the French and Welsh models. This means when making comparisons between the efficiencies of different countries, British producers are at a significant disadvantage. This factor has major implications when looking at whether specific countries' agriculture industries meet global targets.

The APPG would like to thank all those who gave up their time to give evidence to the inquiry, both in written and oral form. The interest of those who participated is indicative of the passion of those working in the field and the importance placed on the issue.

This report only scratches the surface of the research and international dialogue that is needed to take on the challenges we face. Nevertheless, we hope that it goes someway to stimulating the debate and elevating the issue up the agenda.

Current Methodologies

Definition of Carbon Footprint

For the purpose of this report a detailed discussion of the definition of Carbon Footprint is not required. In order to frame the report, and for clarity, we will simply work with the definition provided by the UK Carbon Trust:

> *A carbon footprint measures the total greenhouse gas emissions (GHGs) caused directly and indirectly by a person, organisation, event or product.*
>
> *A carbon footprint is measured in tonnes of carbon dioxide equivalent (tCO_2e). The carbon dioxide equivalent (CO_2e) allows the different greenhouse gases[1] to be compared on a like-for-like basis relative to one unit of CO_2.*[2]

For the purposes of assessing the carbon footprint of the beef and lamb sector, the most commonly used approach is a life cycle analysis (LCA). This is also the most widely accepted approach in the UK, although, as this report will convey, it is not a universally accepted model. LCA involves assessing carbon produced by all inputs into the system, such as fertilisers and other fossil fuel-based substances, and then taking a measurement of the GHGs that the system produces. For the purposes of ruminants such as beef and sheep, the main pollutant is methane arising directly from the animals' digestive systems.

Variations within LCA models

The inquiry highlighted that there were a variety of different methodologies and a number of factors that could be included in LCA, giving rise to a number of different available models: Professor Nigel Scollan, of Waitrose, told the group that 16 had been developed since 2007[3]. There appears to be broad consensus in the UK that the PAS 2050 methodology is the most widely accepted, and is the model used by Defra. However, in its evidence, the Committee on Climate Change which, although independent from government, acts as an advisory body to it, stated that its accepted method for calculating production emissions is set out by the International Panel on Climate Change (IPCC)[4].

The PAS 2050 model was developed by Defra in 2008 with the Carbon Trust and the British Standards Institute. In its evidence to the inquiry, Defra said that PAS 2050 was intended to serve as a flexible set of guidelines to cover a broad range of products: "PAS 2050 will not tell you how to write down individual equations to work out greenhouse gases from your business; it will instruct you what the best approaches are"[5].

Throughout the evidence taken as part of this inquiry, it was evident that there was a variation in data arising from the large number of models available. For the purposes of the report, we do not propose a complete analysis of the different models used internationally. However, we would draw interested parties to the work done by The ECO2 Project and EBLEX for a full discussion (see appendix).

This work highlighted the implications of different methodologies for policy making. For example, in England, the footprint of beef cattle (according to PAS 2050)) was 12.65 kg CO2e/kg (live weight) and

---

[1] http://www.carbontrust.com/resources/guides/carbon-footprinting-and-reporting/carbon-footprinting

[2] A carbon footprint considers all six of the Kyoto Protocol greenhouse gases: Carbon dioxide (CO2), Methane (CH4), Nitrous oxide (N2O), Hydro fluorocarbons (HFCs), Per fluorocarbons (PFCs) and Sulphur hexafluoride (SF6).

[3] Professor Nigel Scollan, Oral evidence iv, 14 March 2013

[4] Written submission from the CCC

[5] Dr Luke Spadavecchia, Oral evidence ii, 12 February 2013

sheep was 11.86 kg CO2e/kg (live weight). Comparatively, the figures for Wales were 7 – 51 kg CO_2e/kg (live weight) and 8 – 61 kg CO_2e/kg (live weight) respectively. As this demonstrated, even within countries there was significant variation in the statistics and no way to determine whether these were driven by different efficiencies or by different ways of producing data. This made any form of comparative assessment of carbon footprint very challenging and posed major difficulties for policy formulation.

The APPG concluded that achieving consistency in the figures used should be viewed as one of the top priorities for both the government and industry, who should work in partnership. We urge ministers and officials at Defra to accelerate work at both an EU level and with international bodies, such as the FAO, to seek global consensus in an agreed methodology.

Variations within production systems

As the figures demonstrate, there are significant variations between different production systems and even between different farms. Numerous witnesses pointed this out in their evidence, including the Committee on Climate Change:

> *There is significant scientific uncertainty using this approach as emissions will vary according to the breed of cow, and the type of livestock diet.*[6]

Figures produced by EBLEX[7] highlight this fact across both species:

Beef Production - on farm data Kg CO2 eq/KgLwt	Upland Suckler	Lowland suckler	Dairy Beef	Bull Beef
Averages	15.7	19.2	11.8	10.6

English Sheep Production - on farm data Kg CO2 eq/KgLwt	Hill	Upland	Lowland
Averages	13.6	11.0	11.1

This further compounds the case for consistency in measurement in order that an accurate assessment can be made on the relative merits of each system. However, as discussed later in this report, it is important that these figures are not taken in isolation but are considered in the context of the most efficient use of land.

In New Zealand, work has been done to analyse the impact of different feed types on methane production. A number of different factors were being looked at, including feed type, sugar content in the grass and changing the ruminant microbiology. At one stage the previous government in New Zealand looked at introducing a tax, which was subsequently abandoned, on ruminant agriculture proportional to methane emitted. We would commend the New Zealand government for this initiative. There is no 'one size fits all' carbon figure for production and therefore it is crucial to work with producers to develop methodology to make an accurate assessment of the different emission levels from different systems. Only by improving our data set and understanding of this can we hope to be in a place where we can make accurate assessments of carbon footprint and work with producers to improve them.

[6] Written submission from the CCC
[7] EBLEX written evidence

Where is the measurement taken?

The PAS 2050 methodology calculated carbon footprint from 'cradle to farm gate' where as others stop at different intervals along the supply chain. Once animals leave the farm, there is a large raft of other carbon outputs that arise from processing, transport, retail and finally cooking. In its third roadmap for the beef and lamb industry, *Down to Earth*, EBLEX showed that over 90%of emissions were accounted for on farm.[8] Quantifying post-farm gate emissions was incredibly challenging because the journey each animal took varied. However, this served to support the underlying proposition that clarity was needed to show what each model was measuring, and therefore what that model's relevance was in a holistic assessment of environmental impact.

[8] Down Too Earth, Beef and Lamb Roadmap Phase Three, 2012

Elements not included in LCA

Carbon Sequestration

Carbon sequestration is the process by which CO_2 is removed from the atmosphere by pasture land through a process of absorption and deposition in the soil, which acts as a carbon sink. In essence, this is a natural form of carbon capture and storage. The process is well documented and it is accepted that pasture land does store carbon in the soil. What is the subject of much debate is whether grazing land can have a tangible impact on mitigating emissions from the animals by continuing to sequester carbon, or whether long term pasture land is at equilibrium such that there is no net uptake of carbon. As Professor Pete Smith, of Aberdeen University, told the inquiry:

> *If you have a whole bunch of carbon there at the beginning, and you have a whole bunch of carbon at the end, you do not have net change. For the atmosphere to see any benefit, you need to be sequestering carbon from the atmosphere; where the carbon is not in the atmosphere that is increasing the soil carbon. When soil is at equilibrium under grassland, there is no net change in carbon; the inputs are equal to outputs.*[9]

A number of witnesses to the inquiry support this position and dispute the ability of pasture land to sequester carbon from the atmosphere *ad infinitum*. If this is the case, as Professor Smith questioned, what is the fate of that carbon and what can be said for its long term stability?

However, there were also a number of witnesses who supported the motion that pasture land had the ability to sequester carbon from the atmosphere. This served to highlight the fact that this was a rapidly evolving debate. Much of the change in thinking as to why carbon sequestration should now be included in carbon footprint calculations has its roots in research being done in France by Professor Jean Francois Soussana.

Professor Smith gave his explanation for the emergence of the current division of opinion:

> *These findings are based on flux measurements (using a technique called eddy covariance) which show apparent carbon uptake into the grasslands. If this is robust, we don't know where the carbon is going – the carbon that is taken up could be leached as particulate or dissolved organic carbon, or could be deposited in deep soil – but either way doesn't show up in the topsoil. The flux measurements are uncorroborated by soil C stock change measurements. Rothamsted (and other) permanent long term grass experiments record no such long term increase in SOC, so the use of an assumed C sequestration rate for grasslands is questionable – and highly uncertain.*[10]

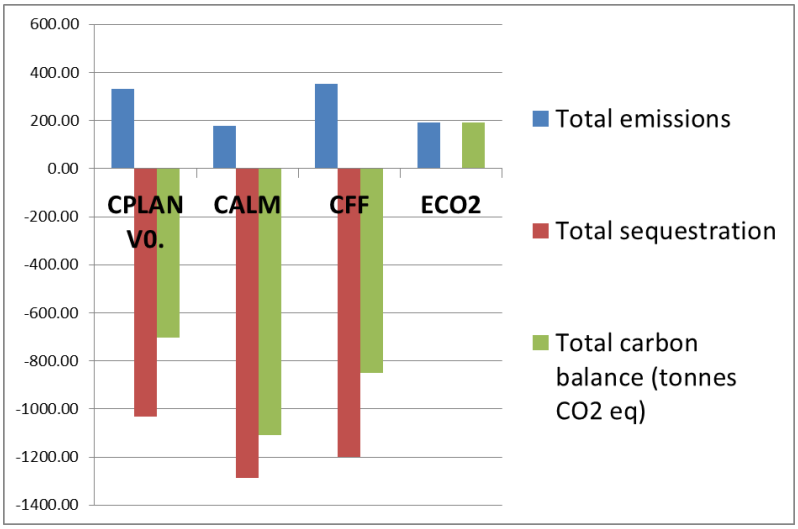
However, Dr Adrian Williams, of Cranfield University, interpreted the research in a different way and viewed Prof. Soussana's research in a more positive light:

> *He [Soussana] led a European project in which the atmospheric flux of carbon dioxide over fields was measured over one or two years on a variety of grassland sites. Some were temporary and some were long term…In quite a lot of those they did find a net uptake of CO2 from the atmosphere into the soil.*[11]

[9] Prof. Pete Smith, Oral evidence iii, 27 February 2013
[10] *Ibid*
[11] Oral Evidence session i, 6 February 2013

Bangor University conducted research that supported the proposition that pasture land can continue to sequester carbon in the long term. It estimated that the farms taking part sequestered about 1 tonne (1025kg) CO2/ha/year, or 58% of their 'local'[12] emissions footprint (25% of PAS 2050 footprint). Three farms sequestered more carbon dioxide equivalents per ha than the 'local' footprint suggested they were emitting, and under this scenario they may be considered C-neutral or net C-sinks[13].

Bill Grayson, a producer, ran four different models for data collection on his own farm. Three of the models showed that the level of carbon sequestration from the land was significant enough to result in the farm being a net absorber of carbon, rather than a net emitter.



Mr Grayson explained the difference in the results obtained by the four models, which shows the impact that inclusion of sequestration can have on the total figure:

> *The reason for this dramatic turn-round is because all three of the internet-based calculators include C-sequestration by the farm's trees, other vegetation types and, to some extent, its soils, recognising that these too contribute to the system's overall productive output, even if this is less directly. It is this greater inclusivity that, I would argue, makes their estimates of the farm's C-balance more robust. The ECO2 methodology, by contrast, targets only those components that are directly connected to the production process itself, omitting these key components from the rest of the farmed environment. This situation is obviously very unsatisfactory, leaving farmers unsure about which approach is the right one upon which to base their mitigation decisions.*

Clearly, the issue of carbon sequestration is hugely significant for the industry. If evidence can be found to prove that managed pasture land is able to remove carbon from the atmosphere, thereby mitigating against some of the methane emitted from grazing livestock, this could potentially have major implications for our understanding of the carbon footprint of livestock. Additionally, this would render the current PAS 2050 model incorrect and would mean we should move to a model closer to that used in

[12] IPCC and PAS 2050 require the use of standard, internationally-accepted emissions factors and values in calculating a carbon footprint. However, these values are applicable to large geographic areas and may not reflect emissions at national scale. We calculate a second footprint for each farm that differs from the Tier 1 PAS 2050 – compliant footprint in using a UK-specific value for emissions from organic (peat-derived) soils measured in Scottish and Welsh upland areas (ECOSSE, 2007) and which is considerably lower than the accepted IPCC values.
Taylor, R., Jones, A., Jones, G.E. (2010*) Measuring Holistic Carbon Footprints for Lamb and Beef Farms in the Cambrian Mountains Initiative.*

[13] A Review of International Carbon Footprint Results & Methodologies, EBLEX and ECO2

France. As numerous witnesses told the inquiry the science is unresolved and therefore requires further investigation.

Dr Luke Spadavecchia, of Defra, explained what he viewed as the limitations in the scientific research behind carbon sequestration and why Defra opted not to include it.

> *The question of whether or not it is a good idea to include carbon sequestration in life cycle assessment is kind of an open one at the moment. It is something that is rather difficult to do because changes in practice on a given farm will impact on soil carbon concentrations, but the soil does not have an infinite capacity to sequestrate the carbon. Therefore over time you will see gradual changes in the amounts of carbon in the soil as the inputs of carbon are balanced by the turnover in the soil. That typically takes around 100 years to happen in temperate climates, with gains of carbon happening much slower than losses of carbon. Therefore, in order to have a meaningful sequestration through land use change and land management those changes have to be made in perpetuity. There are concerns over the stability and long-term fate of that carbon*[14].

While sequestration is not recognised by the UK Government as having a significant impact on net greenhouse gas balances, it is included in the model used in France. Clearly, emissions from food are a global issue and this reinforces the point made by numerous contributors to the inquiry that a lot more work needs to be done to standardise the methodology for measurement internationally. This is especially important if we are to make realistic comparisons between different nation's ability to produce livestock efficiently. If, for example, we compare the impact of livestock in the UK and in France using nationally-produced data then our producers will be hugely disadvantaged because French data will include sequestration. We would urge Defra to look into this matter as a priority and, if we are to see greater co-operation between nations in our effort to respond to environmental and food challenges, migrate to the model accepted in France. If the government does not view this as a viable course of action, then it needs to make a robust case for why not. The disparity built into the *status quo*, is no longer acceptable in a global debate.

Advocates of a meat-free diet often argue that land currently used for grazing animals should be turned into arable farm land to grow crops, as they have a lower carbon footprint. However, one of the dangers of doing this that is often left out of their arguments is that a large amount of carbon is released into the atmosphere when the land, which is a carbon sink, is ploughed up. Because it is very difficult to quantify the carbon stored in the sink, it is hard to make an accurate calculation as the overall 'reduction' in carbon emitted from the entire system. Lawrence Alderson supported this view when he wrote in his 2008 paper for the journal of the Royal Agricultural Society of England:

> *Soils are the largest carbon reservoir of the terrestrial cycle, and the disturbance of forest, woodland and pasture can make a significant impact on the carbon balance (Rice, 1999). Estimated emissions of CO_2 equivalent in Scotland in 2005 attributed more than 70% to losses from land converted to cropland and from agricultural soils. Therefore, the focus should be on agricultural processes that use fossil fuels and contribute to deforestation and ploughing up of pasture, rather than on livestock digestive processes*.[15]

Chris Jones, of the Woodland Valley Farm, conducts his own carbon auditing, further supporting this argument. He explained:

[14] Dr Luke Spadavecchia, Oral evidence ii, 12 February 2013
[15] Grazing livestock and greenhouse gases in the UK, Lawrence Alderson, Journal of the RASE, 169, 2008

> *The impact of cultivation was enormous – ploughing up pasture to grow corn releases large volumes of soil carbon into the atmosphere, whereas carbon accumulates in soil under perennial cover.* [16]

It is important that the carbon released through land use change is recognised. As policy in this area is developed, it needs to take into account all the carbon consequences attached to different agricultural crops, and in particular the major impact of resulting from the disturbance of pastureland.

Land Management

It is well documented and understood that grazing livestock plays a major role in the management of the landscape. The effect of removing grazing livestock has been visually qualified by Land Use Consultants on behalf of EBLEX in *Landscapes Without Livestock*[17]. However, the inquiry found that no current methodology exists to include this in an assessment of carbon footprint, despite the fact the loss of hedgerows and pasture land, for example, would evidently impact the amount of carbon removed from the air. This does not even begin to take into consideration other uses for the agricultural land beyond leaving it to the natural elements, such as tourism or development.

Another inadequacy of the LCA methodology is its failure to include all emissions from inputs to, and outputs of, the soil and land, as Bill Grayson explained:

> *In carbon terms, boosting dietary value is unlikely to offer another win:win outcome, since savings in direct emissions from faster growing livestock must be accounted against additional emissions arising from the increased effort invested in producing the better quality forage. The increased levels of cultivation and greater use of chemical fertilizers will in most cases result in losses of soil organic matter. These ancillary emissions are not included in the current LCA calculations, a situation that will inevitably lead to poor results for a farmer wishing to reduce their GHG emissions*.
>
> *By ignoring C-exchanges associated with different types and intensities of land use and soil management, it fails to provide the comprehensive C-budget that is essential if farmers and other land managers are to accurately assess their carbon-performance.*[18]

Biodiversity

It is well documented qualitatively that grazing livestock makes a valuable contribution to biodiversity and the preservation of ecosystems. For example, hedgerows provide habitats for many species which are themselves vital for fauna and flora. It is not within the scope of this inquiry to elaborate on the specific ecological detail any further, but interested parties may wish to read *Landscapes Without Livestock* which expands on this point.

However, as numerous witnesses pointed out, there is a positive environmental contribution of biodiversity and it is important to bear this in mind when considering the overall environmental impact of agriculture. Quantifying the carbon value of biodiversity is incredibly difficult and is not something that LCAs take into account. The evidence suggests that it will be a major challenge to find an agreed way of quantifying this benefit in the short or medium term. This exposes the weaknesses of simply looking at carbon footprint as a measure of environmental impact and we urge policy makers to consider this point. In particular it is felt that the risk to biodiversity does not receive due consideration when environmental

[16] Woodland Valley Farm submission

[17] http://www.eblex.org.uk/documents/content/publications/p_cp_landscapes_without_livestock_report_emailable121211.pdf

[18] Bill Grayson, written evidence

organisations call for a reduction in meat consumption, which would ultimately lead to a reduction in the number of grazing livestock.

Defra stated that this was something that they were looking into and the APPG welcomes the outcome from this project:

> *Biodiversity impacts landscape, which impacts social values that are very hard to put numerical or monetary value on – they are protected by these more extensive systems. We have a project looking at the wider considerations around life cycle analysis and the development of methodologies for assessing environmental, economic and social characteristics of farming systems. This is an attempt to try to develop metrics to capture some of these wider scale impacts that farming systems might have, which are aside from the greenhouse gas issues.*[19]

Maximising value obtained from land

The question of how we feed a population of 9 billion by 2050 is one of the most pressing issues facing the world today. The answer, so much as it exists, is incredibly complex and covers a broad range of issues. However, what is pertinent to this inquiry is how to maximise the value of available land by getting the best possible outcome in terms of food production.

British agricultural land comprises many different land types and not all are suitable for the production of all types of arable crops. This point was eloquently made by the Food Climate Research Network in their evidence:

> *Not all land can support crop production and the question then arises – what should be done with this poorer quality, more marginal land? Traditionally the answer has been to graze ruminants which then provide us with meat, milk and other outputs. This represents a form of resource efficiency – the land is being used to produce food that would otherwise need to be produced elsewhere – and that 'elsewhere' could either be existing prime agricultural land, where competition with grain production for human food consumption could arise, or on land deforested for the purpose.*

The submission goes on to point out:

> *Moreover, if well managed, grazing livestock on pasture can yield other multiple benefits.*[20]

In the United Kingdom almost 65% of UK farmland is only suitable for growing grass where sheep and cattle are grazed. Therefore, as the FCRN paper highlights, using this land for ruminant grazing, as opposed to nothing at all, represents the most efficient way of creating food from it. Although the FCRN also notes that the benefits of using land for livestock should be considered in the broader context of limits on overall consumption, and that livestock production should only occur on land unsuited to other purposes.

This point is often neglected, or at least not adequately considered, by those who advocate meat-free diets. If, for argument's sake, we were all to switch to a diet free of meat, much of our agricultural land would simply be unfarmed and we would see a considerable drop in the efficiency of our land to food conversion, in addition to the negative impact on biodiversity as outlined above.

It is important however, that we consider this point in a holistic sense and also seek to avoid, where possible, the use of prime arable land to grow food that is then used to feed animals, as the FCRN goes on to say:

[19] Dr Luke Spadavecchia, Oral evidence ii, 12 February 2013
[20] *Intensive versus extensive livestock systems and greenhouse gas emissions*, FCRN, January 2010

> *With growing human populations, prime agricultural land for crop production (which supplies the bulk of our energy needs) is increasingly scarce, and it is questionable whether this land should be given over to produce feed that goes to feed animals. Owing to feed conversion losses during the course of converting plant-calories into animal-calories, the nutritional benefits we gain from eating the meat, or milk or eggs that results from these feed inputs, are lower than they would have been were we to have consumed the grain directly.*[21]

However, as Woodland Valley Farm indicated, this choice is not just dictated by soil and land quality, but also by weather conditions. As climate patterns in the UK change, we must be mindful of this point and use the land that we have to produce food in the most resource efficient manner:

> *With the wet summers we have been experiencing in Cornwall we could not grow cereals of a quality to feed humans, so were producing cereals to feed ruminants which are not designed to eat them.*[22]

This is a very important point and, in the global context, represents one of the biggest challenges facing all nations. LCA does take into account emissions associated with deforestation or conversion of grassland to arable farming land for feed production, e.g. soy and palm meals. But, as Professor Scollen told the APPG when giving evidence:

> *What it [LCA] does not do at all is take into consideration the key purpose of the ruminant animal, which is effectively the conversion of feed materials that we as people cannot consume and which the ruminant animal can do with the assistance of a microbial population within their rumen…. If you were to take into account the type of feed that these animals are eating – grass and other by-products – then we quickly see that actually in terms of efficiencies of what is called non-human edible material into food then actually the ruminant animal will come out number one in that set of calculations.*[23]

The degree to which LCA does not take into account this efficiency has proven to be one of its greatest inadequacies. Other forms of livestock that often appear to have lower carbon footprints, such as pigs and poultry, rely on these feed inputs to a far larger extent.

Ruminants play a unique role in food production because of their ability to turn non-human food into edible protein and nutrients. Limiting the role of British livestock will reduce the efficiency with which we use our land for food production and therefore reduce our ability to be self-sufficient. This is summarised well by FCRN:

> *Ruminants are able to consume food and agricultural by-products that humans cannot or will not eat (spoiled crops, citrus peel, rice husks and so forth); the diets of commercially reared pigs and poultry consist largely of cereals (such as wheat, barley, maize) which humans can consume directly, as well as soymeal.*[24]

Although this report is obviously focussed on beef and lamb industries, it is worth pointing out that they are not the only examples as other livestock as well as egg and dairy production also have a major role to play in the production of carbon emissions.

[21] *Ibid*
[22] Woodland Valley Farm submission
[23] Professor Nigel Scollan, Oral Evidence iv, 14 March 2013
[24] Intensive versus extensive livestock systems and greenhouse gas emissions, FCRN, January 2010

Improving feed conversion efficiency is a major goal for the industry. Naturally, if producers are able to introduce more efficient practices, they should be able to reduce their financial inputs and increase margins. In this way it represents a 'win-win' situation.

International variation in carbon footprint calculation

As we discuss throughout this report, there is a wide variety of methodologies to calculate carbon footprint that have been developed throughout the world. In the UK, we have an 'accepted' methodology, but throughout the course of this inquiry numerous groups have pointed out a number of weaknesses in the model and a number of factors that are not included.

This presents us with a number of limitations in terms of our ability to formulate a global response to managing the emissions produced by ruminant livestock. Until more progress is made towards consensus this will continue to act as a glass ceiling. Defra set out its view that the objectives of LCA should be to provide "a relative ranking of different systems analysed with given models" rather than to place an absolute number on each farm. Whilst we can see there are merits in this approach, it becomes a moot point unless everyone is using the same LCA model and everyone is collecting data in the same way. In the UK, there appears to be some, but not total consensus, while internationally there is huge variation. It was summed up aptly by APPG member and former Minister for Food and Farming, Sir Jim Paice MP when he said, "every debate is completely meaningless because we are comparing apples and pears".

Two main factors stood out as causing the severe limitations on progress: a failure to understand where the responsibility lies, and cost.

i. Responsibility

In the UK, the primary responsibility to drive forward the research necessary to have a more informed debate should reside with the lead department – Defra. Of course, the industry also has its role to play in the process. However, Defra's position allows it to be more balanced.

The debate does not just cover the UK and so a more coordinated response is required globally. We would urge Defra to work with its international equivalents and supranational bodies, in particular the EU, to push for the necessary evidence to inform consensus. Only when this is achieved and we are all working from the same base model can we have a sensible debate about the matter.

ii. Cost

The APPG recognises that conducting high-quality, robust scientific research is expensive and that the government has a duty of fiscal responsibility. Defra should look to work with other interested NGOs, levy bodies and academics to ensure that the resources available to all these groups are used wisely and the approach is coordinated.

Current activity

At Defra, this area of policy falls within the remit of the Competitive Farming Systems team, which spends between £11-12m per annum on research. On this subject, Defra told the inquiry that approximately third of that money gets spent on sustainable and competitive farming systems.

In terms of assessing the methodology behind the science, it is crucial that the government take a lead on the issue and the APPG was pleased to hear that Defra are looking into achieving greater consolidation:

> *We have a project looking at the wider considerations around life cycle analysis and the development of methodologies for assessing environmental, economic and social characteristics of farming systems. This is an attempt to try to develop metrics to capture some of these wider scale impacts that farming systems might have, which are aside from the greenhouse gas issues.*

> *In a separate part of Defra, there is work going on to look at these issues around carbon sequestration and the land use, land use change and forestry inventory. I am closely involved in that work as well. Those emissions in sequestrations are thought to be a much smaller part of the story in terms of agricultural than the former issues stated.*[25]

This is unquestionably not something Britain can resolve by itself and requires cooperation and consensus at a supranational level, both from NGOs and intra-governmental organisations. Therefore, the first logical step is to seek agreement at an EU level, particularly given the prominent role the EU plays in agriculture policy. Dr Luke Spadavecchia, from Defra, explained recent progress made at an EU level to ensure consistency:

> *There was a recent EU Commission decision to make what is at present, in international inventory, the reporting of land management impacts in soil carbon, a mandatory reporting activity. It was previously a voluntary reporting activity…The EU is certainly encouraging people to have a more complete reporting of their land use, land use change and forestry emissions. The soils team of Defra has always been minded to be as complete in our reporting as possible. The problem that we have historically had is a difficulty in terms of the activity data to support that reporting, but there is a project that is ongoing at the moment within Defra to look at some of these land management options and the impacts that they will have on the land use, land use change and forestry inventory.* [26]

As part of this work the team is aiming to support that effort:

> *We have got a large and ambitious platform project that is looking at UK agricultural systems and the emissions that are associated with those, both in terms of nutrient management – which is the largest source of emissions from the agriculture sector – and the enteric and manure management emissions associated with livestock, which is the next largest source of emissions.*[27]

The evidence that the Group heard and this report shows that there is a strong case for an EU-wide system of quantification of CO2 and Methane. Given where we are today, this is evidently an ambitious goal, but, given the importance of the challenges facing us, not one from which we should shy away.

Engaging with producers

One of the challenges identified by EBLEX and others is engaging producers in the issue. As ECO2 pointed out in their evidence:

> *In the beef and sheep sector, if the farmer does not have any appetite for carbon then it is harder to encourage them to do something that will take up some time (although it may provide their business with some ideas on how to improve) and they would point to the fact that they could sell produce elsewhere or direct into a livestock auction where they would not need to go through these steps.*[28]

Giving evidence to the APPG, Chris Lloyd, of EBLEX, explained that the English beef and lamb industry's levy body did a large amount of work to help farmers engage with the issues, although it was a challenge. Through its three roadmaps EBLEX had helped demonstrate to producers that there was a direct financial benefit for them to reduce their carbon emissions.

[25] Dr Luke Spadavecchia, Oral evidence ii, 12 February 2013
[26] *Ibid*
[27] *Ibid*
[28] ECO2 written submission

In order to see a meaningful reduction in the carbon footprint of agriculture this work must continue and we would urge Defra to work with EBLEX to ensure that the necessary funds are available to support it. This has two important components:

- Investment in research and development of farming practices in order to make them more environmentally efficient.
- Helping producers to understand the issues both from a top-level global perspective and also how it will help them run more efficient businesses.

The role of retailers

Retailers and food service providers have a major role to play in improving the sustainability of the industry. We were pleased to see McDonalds and Waitrose engage with the inquiry and welcome the work that they do.

Waitrose stated that they "engage closely with our farmers through an annual conference, two lamb supply chain events in November and a programme of engagement planned for 2013 with our beef supply chain"[29] and we would urge other retailers to consider activity of this nature, if they do not already.

This APPG recommends that future development needs to focus on two key areas:

i. Communication with consumers

Retailers and food service sit at the top of the supply chain and therefore have the unique position of having direct contact with consumers. They therefore have an important role in helping consumers to make informed purchasing decisions. We see this as being analogous to their role in the accurate nutritional labelling of products.

It is important that consumers understand the balance between animal welfare, nutritional value, environmental impact and food security.

As Daniel Crossley, of the Food Ethics Council, told the inquiry:

> *We need to move the debate on, hence the latest work we did was around a report called 'Prime cuts: Valuing the meat we eat'. That is deliberately pitched emphasising how we should value meat more, but also trying to move to definitions of what better meat might look like – better for climate change, better for health, better for animal welfare and potentially better for farmer profitability as well. From that perspective there is a lot more work needed to understand and move forward that debate.*[30]

Different production systems have different credentials in all areas and consumers need to be in a position where they are able to balance all three to make an informed decision. In some cases improving one are can mean making a concession on another. Knowledge and understanding empowers consumers.

ii. Sharing investment costs

The APPG heard numerous witnesses explain that farms which operate with lower emissions are both environmentally sound and cost efficient; the so called 'win-win' argument. However, this often requires an up-front investment from the producer.

Waitrose told the inquiry:

[30] *Ibid*

> *[Waitrose] are in year three of a project encouraging our lamb farmers to select their rams on EBVs [Estimated Breeding Values] and quantifying the benefits from a cash flow/profitability perspective - evidence suggests the lambs from the high EBV rams are ready for the market place earlier than from the standard rams with carcase grades also consistently good - which is the evidence needed to influence farmers to change practice and purchase the higher genetic merit rams.*[31]

We commend Waitrose in this work and hope other retailers take the same responsible attitude. However, we would issue two lines of caution.

Firstly, as well as knowledge transfer, we also believe retailers should support producers by shouldering some of the initial investment. Distribution of monies within the chain is something that is of major concern to producers and is often the subject of correspondence to their Member of Parliament. While supply chain dynamics fall beyond the scope of this inquiry we feel this is an important point in relation to the mitigation of carbon emissions. All levels of the supply chain, from farm to plate, have a responsibility to reduce environmental impact and that means sharing the cost of investment. For those who wish to read into the matter in greater detail we would draw your attention to EBLEX's 2012 report on supply chain dynamics, *Balancing the Market*. However, we would simply echo the words of EBLEX Chairman, John Cross, who said in his foreword:

> *There should also be a greater spirit of cooperation in tackling shared challenges. The climate change issue remains high on the agenda and it is right that we should all be looking to ways of cutting our carbon footprint.* [32]

Secondly, we hope that this environmental responsibility applies across the market and is not simply concentrated on produce aimed at consumers who are able to pay a little more for meat than others. All elements of the supply chain, including consumers, have to shoulder the responsibility of environmental sustainability and play a role in ensuring we are able to feed future generations.

[31] *Ibid*
[32] Balancing the Market, EBLEX, May 2012 - http://www.eblex.org.uk/documents/content/publications/p_cp_eblex_balancing_the_market_final_220512.pdf

Conclusion

Former Vice-president of the United States of America, Al Gore said of global warming, "We are facing a global climate crisis. It is deepening. We are entering a period of consequences". We should all take these words very seriously and place any form of carbon emissions under heavy scrutiny to determine whether they can be reduced or even whether they are necessary at all.

However, we also have to feed ourselves. And as the UK's and world's population increases food security becomes equally concerning. It is clear that we need to balance the two threats in order to formulate a global response that ensures we are still able to use the natural resources available to us as a source of food while preserving this right for generations to come.

The beef and lamb industry is a net emitter of carbon and therefore has to accept that it has a duty to reduce its environmental impact as much as is possible. From our evidence, we are confident that the industry accepts this responsibility and is working on the challenges of meeting it. What this inquiry has exposed is that in order to have an informed debate, and to generate a set of policies that enable the industry to meet this challenge, much work needs to be done to ensure that the scientific foundations are solid.

Much of the discourse is framed around the principle of carbon footprint, yet this term seems to be too ambiguous to be able to work satisfactorily. There is much more work needed to define how we measure the carbon footprint of the beef and lamb industry, and, indeed the carbon footprint of all agriculture sectors. What is evident is that if this debate is to happen where it needs to – i.e. beyond national borders – then a global effort is needed to achieve international consensus on what a carbon footprint includes.

The "eat less red meat to save the planet" message is far too simplistic to be credible at this stage. Because we are not fully able to quantify the carbon footprint of red meat, nor are we able to fully quantify the carbon footprint of the foodstuffs that we would seek to replace meat with, this argument lacks the scientific grounding to be robust.

Pastoral agriculture has a number of important positive environmental impacts – some of which we should be in a position to quantify in terms of carbon. The fact that the producer Bill Grayson managed to use three different models to show that his farm is a net absorber of carbon versus one to show that it was a net emitter indicates the inconsistency of the models available.

It seems that within the concept of carbon footprint, sequestration is the biggest issue of contention and, if it is found that pasture land can absorb some of the carbon produced by the animals, this has the potential to completely change the debate. This does not begin to touch on the other benefits of agriculture which are very difficult to capture in carbon terms, such as the benefits the sector brings in terms of land management and biodiversity. Further, stepping away from the environment briefly, the beef and lamb industry is also a vital employer up and down the UK and farming plays a vital role in community cohesion of rural areas. This is something that MPs representing rural communities are only too well aware of.

This report only begins to scratch the surface of the intricacies of the debate around sustainable food production. But what it shows is that the scientific evidence and data available to us remains too insufficient to provide policy makers with the framework needed to respond to one of the most pressing issues facing global society today.