

## Climate Change and Agriculture

– closed POST lunch briefing event

**Tuesday 7<sup>th</sup> February 2019, 12.30 – 14.00, Board Room, Richmond House**

POST held this event for parliamentarians to discuss with experts from academia, government and farming the challenges arising from agriculture being one of the most vulnerable sectors to climate change impacts with implications for food security, as well as being the fourth highest greenhouse gas emitting sector globally. Focus was given to discussing the options for mitigation of emissions from agriculture, the impacts of climate change on agriculture, and the options for adaptation of agriculture to climate change. The event was chaired by Lord Teverson, Chair of the Lords EU Energy and Environment Sub-Committee and member of the Lords European Union Committee. Attendees heard briefly from seven speakers during the discussion:

- **Dr Robin Fears, European Academies Science Advisory Council (EASAC)**
- **Dr Marco Springmann, University of Oxford**
- **Professor Tim Benton, University of Leeds and Chatham House Visiting Fellow**
- **Richard Bramley, Farmer and North East representative on the NFU National Environment Forum (with Dr Ceris Jones, NFU Climate Change Advisor)**
- **Professor Joe Morris, Cranfield University**
- **Indra Thillainathan, Committee on Climate Change**
- **Dr Luke Spadavecchia, Defra**

### Lunchtime briefing summary

**Lord Teverson** opened the event, stated that the event would focus on climate change and agriculture, and thanked the speakers for attending.

### **Dr Robin Fears, European Academies Science Advisory Council (EASAC):**

Published [IAP reports on Food and Nutrition Security and Agriculture](#) last year. An EASAC report on Climate Change and Health will be published later in June 2019.

- The IAP reports support a broad strategic objective of coordinating policy across the health, environment, food and agriculture sectors. Changes are needed not only in agriculture, but across the whole food system, as all stages contribute to climate change and are affected by it. For example, climate-smart food processing needs to be considered. A food system approach allows collaboration with other policy areas; for instance, dietary changes can have co-benefits for health. For example, tackling overconsumption of calories can help cut food waste and greenhouse gas (GHG) emissions as well as having significant health benefits. However, policy decisions to tackle dietary change, such as a meat tax, should consider impacts on vulnerable groups who may already be at risk of malnutrition and implement social protection measures.
- The [POSTnote on Climate Change and Agriculture](#) mainly focuses on the UK, but the UK Government should recognise the responsibility not to export problems to other areas of world. Exporting emissions has consequences for resource use (e.g. water, land) elsewhere and we need to be careful not to exacerbate those issues.
- Technologies for adapting climate change need to be supported, such as crop science for improved crop breeding. For example, these technologies could help reduce pesticide use if they

could be implemented within a flexible and proportionate regulatory system. The current EU classification of GMOs is not evidence based and the EU directive on this should be reformed. Investment in fundamental research in this and other areas should continue, as basic research with no initially identified application, such as on the CRISPR Cas enzyme, now underpins lots of applications in agriculture and medicine.

- There are uncertainties in projecting the future level of climate change. For example, if the Atlantic Meridional Overturning Circulation (AMOC) continues to weaken, then the UK may be susceptible to cooling rather than warming in the future. Different possible emissions scenarios will also produce different impacts on agriculture; progress towards a zero-carbon economy will reduce the impacts.

### **Dr Marco Springmann, University of Oxford:**

Population health requires adaptation of fruit and vegetable production to climate change. Reducing meat and dairy consumption has benefits for health and will mitigate food production GHG emissions.

The impacts of climate change on agriculture include:

- Climate change related deaths because of reductions in fruit and vegetable production and subsequent lower consumption are estimated to be around 4,000 in 2050 in the UK alone ([Springmann et al., 2016](#)). Globally, there could be half a million climate deaths related to fruit and vegetable climate change losses.
- Low fruit & vegetable consumption are currently estimated to contribute to 30,000 deaths ([GBD Diet Collaborators 2019](#)), which are projected to increase deaths by 13% with climate change. By contrast, dietary change to a nutritionally balanced flexitarian diet would save over 100,000 deaths ([Springmann, Wiebe, et al., 2018](#)).
- Adaptation changes needed include an increase in the domestic fruit and vegetable sector, health promotion programmes to increase consumption of fruit and vegetables and investment in breeding programmes globally to enhance the resilience of fruit and vegetable production.

Measures to reduce GHG emissions from food production include:

- Changes towards more plant-based diets, together with decarbonisation of the energy and transport systems, to avoid dangerous levels of climate change ([Springmann, Clark, et al., 2018](#)).
- The global food system is responsible for about a quarter of all GHG emissions, most of which are from animal products (beef and milk alone account for more than half). In the UK, the contribution depends on what is measured; the official statistics state 8-9% of emissions are from agriculture in 2017, but most of the CO<sub>2</sub> emissions are allocated to other sectors. If CO<sub>2</sub> is included (a more comprehensive accounting), then emissions increase by about 50%, and if imports are accounted for, then emissions would be 80% higher. Emissions from food production are projected to stay the same, if policies are not implemented to change diets.
- As meat and milk are the largest sources of emissions, changes towards more plant-based diets are effective for reducing emissions, by about 50-70%. In absolute terms, that would be about 35-70 MtCO<sub>2</sub>. This is comparable to the shortfall in the fourth emissions budget noted by the UK Committee on Climate Change (shortfall is 205 MtCO<sub>2</sub> over five years = 41 MtCO<sub>2</sub> per year), suggesting plant-based diets can help the UK to fulfil its domestic climate targets.
- Possible actions to encourage dietary change include: updating current dietary guidelines to be in line with the latest health evidence and environmental considerations, taxing foods according to GHGs emissions with the revenue used to compensate low income households and incentivising farmers to mitigate GHG emissions.
- Studies suggest flexitarian diets can be about a quarter cheaper and it is estimated that the value of saved lives under a healthier, flexitarian scenario would be double value of the current NHS budget (£265 billion).

## **Professor Tim Benton, University of Leeds and Chatham House Visiting Fellow**

I am currently involved in two major projects: post-Brexit food systems in the UK and the IPCC special report on land degradation. Both projects highlight the complexity of the governments problem in dealing with societal change around climate change.

- If net-zero GHG emissions are not met by 2040, carbon dioxide will need to be drawn out of the air. This will require land for afforestation or Carbon Capture and Storage (CCS) plants. The longer it takes to reduce emissions, the more land will be needed to draw down emissions. If the policy focus is kept on increasing agricultural productivity, incentivising the externalising of GHG emissions and resource-use, a vicious circle will be created.
- There are potential large-scale tipping points in the climate system that are hard to predict. For example, the climate in the UK is hypervariable because the position of the Jet Stream and the Atlantic Meridional Overturning Circulation (AMOC). If these tipping points are realised, this may have large implications for the global ability to produce food. The food price spikes in 2010 and 2011 that led to the Arab spring were due to the loss of just 0.3% of global calories. If the Jet Stream overturns, then 20% of global calories could be lost, leading to political destabilisation.
- The challenges of climate change are not being dealt with anything like the urgency required. With Extinction Rebellion and the school climate strikes, the social momentum for action appears to be building. Unless our systems change, change will be forced upon us. One of these changes is to diets to change demand for agricultural produce. This will get us away from growing a lot of food that makes us ill, throwing away a lot of food and degrading the planet. Although making these changes is complicated by the governance challenges, we have to face up to the changes required to avoid climate geopolitics destabilising future generations. Focusing on sustainable intensification and technological fixes and business as usual will not be enough. We need to get the whole food system right, including the links to trade and the environment.

## **Richard Bramley, Farmer and North East representative on the NFU National Environment Forum (with Dr Ceris Jones, NFU Climate Change Advisor)**

Conversations in Westminster will affect how farmers will farm in future. The NFU is forward looking and aware of effects of climate change we will face.

- My farm is an arable farm between York and Selby. We are already seeing the impacts of climate change in drought and floods. We are lucky in the UK to farm in a temperate, maritime climate. We have varied landscapes, good soils, and good farmers willing to work to improve soils and sustainability, but it is not helpful for commenters to talk about farmers as the problem, when they are under economic pressure. Continuing to grow food in the UK will avoid importing large amounts of fresh food, such as by air freight, which contributes to GHG emissions.
- Farming has lots to offer on climate change mitigation and adaptation, including carbon capture and alternative raw materials. For example, growing cover crops between cash crops builds organic matter, reduces reliance on inputs and increases the resilience of soils and crop and locks carbon into soil over the long-term. However, a lot of farmers can't afford to think that long-term. Development of crops (through genetic research) resistant to weather extremes, pests and with a reduced need for inputs could be fast tracked to increase productivity, but regulation currently prevents farmers from using these technologies. Also, the UK could and should lead on an emerging 'bio-economy'. Farming could grow bioenergy crops, to meet their on-farm energy needs and/or for sale to the market.
- The answer to climate change mitigation in agriculture is not going to be veganism. Grazing lands for livestock produce lots of by-products, provides market support to other areas and soil enrichment services.

- As species on this planet we have overstepped the mark and adaptation of farming will be vital. NFU have set a net zero target by 2040, but stakeholders need to engage with farms to build this approach. Whole supply chain needs to value properly the products from farms. Post EU agricultural policy should support farmers in sustainable intensification. Food security is a real challenge and although British farmers want to lead the way, they can't do it in isolation.

**Professor Joe Morris, Cranfield University**

There is a two-way relationship between agriculture and climate change: climate change impacts agriculture, but agriculture also contributes to climate change. This problem is diffuse across space and time and spread across the landscape. There is an important international dimension; food security, rural livelihoods, water resources, energy, soil management cannot be seen in national isolation. This implies an integrated solution that builds climate change into decisions at all scales. Science can inform this policy and practice, but it requires a commitment to building institutional capacity:

- Nine years ago I was involved in the [Government Office for Science Foresight Land use in the UK in 21<sup>st</sup> century project](#). That report touched on many of these issues: growing pressure on land, climate change, the need to live within environmental limits, and the strong case for integrated climate mitigation and adaptation. Thanks to the subsequent reports and recommendations of the Committee on Climate Change (CCC) there has been progress in this direction.
- Many implications of climate change for land use may create large tensions with other land use sectors. Despite the potential for conflict, there are many synergies as well as some significant trade-offs. Science can inform the policy process that seeks to address these.
- However, the current policy framework is fragmented. There needs to be an overall strategic approach to align policy approaches, but there is a reluctance to commit to such a strategic approach. The Defra Environmental Plan recognises the need for a joined-up approach, but mechanisms to achieve have yet to emerge.
- Transformational policy change is needed and the four main points of transformation needed are: a clear commitment to a strategic approach that integrates climate change into major policy domains; a continual underpinning of policy and practice by research and development; solutions needs to be context specific, effective, and practically relevant and spatially specific to the different regions of the UK even though this degree of granularity makes it more challenging; and, build in buy-in with stakeholders by developing the science base to build towards practical options, which can be supported by guidance and incentives.

**Indra Thillainathan, Committee on Climate Change (CCC)**

I worked on the [CCC report on Net-Zero emissions](#) published last week, so I will draw on this work as well as the [CCC report on Land Use from 2018](#).

- 10% of UK emissions (excluding emissions from international aviation and shipping) are from agriculture. This has reduced by 16% since 1990, mainly because of CAP reforms that have reduced cattle numbers and other EU environmental legislation that have targeted other pollutants (e.g. the Nitrates Directive) but indirectly reduced GHG emissions. However, in the last ten years agricultural emissions have flatlined as other sectors decarbonised and if that continues, the share of emissions from agriculture will rise. So a more concerted effort in line with other parts of the economy is needed.
- The CCC net-zero scenario includes a 43% reduction in agricultural emissions by 2050, which requires key changes in agricultural practices and land use. Non-CO2 GHG emissions are reduced by increasing low-carbon farming practices that reduce emissions from soil and livestock

management. Transformational land use reduces both non-CO<sub>2</sub> and CO<sub>2</sub> emissions by taking one fifth of agricultural land out of production. This scenario maintains agricultural production at existing per capita levels, so the UK would not be exporting emissions. Alternative land uses to lock in carbon include afforestation, peatland restoration and bioenergy crops. At same time moderate dietary change to reduce consumption of beef, lamb and dairy by 20% is assumed.

- A lot of the measures suggested can deliver win-wins for land managers and farmers. For example, efficiency savings from low-carbon farming practices, changes in land use can alleviate flood risk, improve soil and air quality, and provide a diversified income stream for farmers. If there is to be no direct subsidies for farmers post-Brexit then a diversifying income may be needed.
- The CCC welcomes Defra's proposals for the Environmental Land Management (ELM) scheme to include climate change mitigation as a public good. However, farmers will need support to transition, such as ensuring they have the adequate skills and training needed to switch to alternative land uses such as growing trees.

### **Dr Luke Spadavecchia, Defra**

I lead Defra's research program to build the evidence underpinning policy development around climate mitigation in agriculture. The UK is leading on GHG accounting capabilities for land use and agriculture, underpinned by on-farm measurements.

- The good news: Since 1990 we are producing a litre of milk with 17% less GHG emissions, and pork with 40% less GHG emissions, and efficiency gains in dairy farming mean that we are now producing 9% more milk than we were in 2000 with 24% fewer cows
- The evidence base on GHG mitigation has been looked at in detail for around 200 individual farm practices. 4 themes of action were identified:
  - 1) Improving productivity efficiency. The main opportunity in GHG mitigation currently lies in productivity gains from converting more of inputs into outputs. There is the potential to address large amounts of inefficient production, which can provide environmental benefits. GHG emissions are really a manifestation of lost opportunity, as they are a symptom of the loss of nutrients and energy that should be captured in agricultural products. It is important to note that productivity improvements do not necessarily imply intensification of systems or a move towards 'factory farming'. All farming businesses, whatever their system of production have opportunities to improve productivity. Many productivity measures are relatively low-tech and relate to improving nutrient and feed management on farms.
  - 2) Innovation presents another significant opportunity. Implementation of novel technologies, including on farm renewables, energy saving and novel breeding technologies.
  - 3) Informing consumer choices to align diets with government's Eatwell guidance and to tackle food waste.
  - 4) Land management to protect carbon stocks, including afforestation and peatland restoration.
- The [Climate Change Risk Assessment](#) and [National Adaptation Programme](#) puts the UK ahead in terms of adapting agriculture to climate impacts. For example, these publications identified risks to crops including drought and heat stress. Since 2003 Defra has been working with UK growers, breeders and seed companies to address these challenges through our crop Genetic Improvement Networks (GINs).
- Leaving the EU provides a unique opportunity to deliver on this policy challenge. In November the Secretary of State announced work to develop a new Farm Emissions Reduction Plan in which we will set out our long-term vision for a more productive, low-carbon farming sector.

- In addition, the Agriculture Bill has set out areas where progress can be made. For example, during the transition period the sustainable productivity package will provide assistance for acquisition of better farming equipment.
- To support Innovation, we will introduce new schemes with our proposals building on the existing Agri-Tech Strategy and the Industrial Strategy Challenge Fund Transforming Food Production initiative. The programme will provide industry co-funded opportunities to develop new technologies that could offer step changes in production efficiency and GHG reduction as part of the 4<sup>th</sup> Agricultural Revolution
- The new Environmental Land Management (ELM) scheme will replace the countryside stewardship, which will provide ‘public money for public goods’. Climate change mitigation and adaptation are archetypal public goods. ELM may incentivise the uptake of more sustainable land management practices that could reduce agricultural GHG emissions whilst providing carbon sequestration opportunities, for example via agroforestry systems
- On dietary change, there is an increasing consensus on the linkage between health, sustainability and GHG emissions, as set out in the [EATLancet report](#) and [Committee on Climate Change \(CCC\) Net Zero report](#). The Government Eatwell guidelines are clear on health benefits, but we must also consider the ecosystem services that well managed livestock farming brings for other outcomes such as biodiversity. The Food Strategy will seek to build a food system that can provide food sustainably including reducing GHG emissions.

## Discussion

- The challenges of population dietary change and potential solutions were discussed, including the potential for exporting of emissions and the problem of Government dictating to people how they live their lives. Solutions included supporting informed consumer choice through promoting visibility of the issues around dietary options and combining fiscal disincentives with subsidies to support vulnerable groups. It was suggested that currently what we eat is dictated by industry with the food system outsourcing the price of environmental degradation. Correcting this market failure and helping consumers to choose a better diet would not be dictatorial.
- The opportunity for the UK, as a small part of the global community, to show global leadership on climate change to larger countries such as China, Russia and the US was discussed. One of the challenges at international negotiations on climate change was highlighted as the lack of leadership on agricultural emissions.
- The removal of constraints on UK policy with Brexit could allow steps to be taken to align trade, health, agriculture and environment policies. However, the tendency of Government departments to work in isolation/silos will make cross-department food policy difficult to achieve in practice.
- The CCC’s suggestion of taking land out of agricultural production was discussed. Food production could be maintained by increasing yield sustainably in combination with dietary change, which could free up grassland currently grazed by livestock. Around 70% of agricultural land is dedicated to grassland, so a 20% reduction in beef and lamb consumption should release land. The importance of considering the difference between intensively and extensively kept cattle for land use and emissions was raised. The CCC’s estimates still suggested that any cattle management system produced higher emissions than pigs or poultry, even if the emissions from imported feed were considered.
- The need for a strategic tool for land use planning was discussed as a policy framework for determining what land should be used for housing, recreation, trees, agriculture etc. Possible steps to achieve this include agreeing a common accounting framework and determining how to apply it at appropriate scales. It was noted that the CCC’s net zero scenario planning considers population growth by 2050 and the land needed to meet housing and food needs. The Forestry Commission have also identified enough areas of land suitable for afforestation to meet the

CCC's afforestation target. It was also noted that the 19% afforestation target in the CCC land use report represents the higher level of ambition, while the 17% target represents medium ambition, which was used for the CCC's net zero scenario modelling.

- The practical changes needed to meet the NFU's 2040 net zero aspiration are under consultation with its members. Actions to transform productivity, store carbon on farmland and increase land-based renewable energy over the short, medium and long term will be identified. It was noted that as the budget for the Environmental Land Management (ELM) plan is not yet known, there is no commitment on how much money farmers will receive. It was suggested that correcting the market failure to reward environmental measures would be more efficient, and that reform of World Trade Organisation (WTO) rules is needed to allow this. Machinery and technology to test out new approaches on-farm is risky and expensive and requires financial incentives.
- The requirement for communication between Government, experts and farmers to share knowledge and best practices for reducing emissions from agriculture was discussed, such as an agricultural extension service to communicate the technical ideas to farmers. The industry-led GHG Action Plan supports farmers with advice and information on opportunities to improve productivity and so reduce GHG emissions. An example of this support is the new Feed Advisors Register that includes training on improving GHG efficiency.
- The need for farms of all sizes and scales to be included in the transition to low-GHG farming was highlighted. A move towards intensification of agriculture to improve efficiency could penalise smaller farms and result in more super farms. The GHG Action Plan supports farms of all types and sizes to deliver GHG emissions reductions within the boundaries of their individual farming system, but there is no one-size fits all solution with the diversity of farm sizes delivering a range of different services. The question was raised what agriculture is for – delivering food, profit, or driving the economy? It was suggested if the overall food system becomes more efficient by reducing waste, then sufficient demand reduction would allow wider adoption of lower yield agro-ecological approaches. These can deliver against multiple challenges such as climate change, water use, pollution and biodiversity. All farming systems – extensive, intensive, organic – can deliver production efficiency improvements, such as taking better account of existing soil nutrient status before applying organic or inorganic fertilisers.
- The influence of agricultural regulations on achieving climate change mitigation goals was discussed. It was suggested that farmers are all motivated by profit and that people want to eat a healthier diet with food produced locally and kindly, not intensively. The opportunity, with Brexit, to change farming regulations was also noted.

#### **Closing remarks from speakers**

- **Joe Morris:** the challenges of integrating climate change into other areas of policy has been raised and the need for a strategic approach to climate change, but the Government is reticent about committing to this.
- **Marco Springmann:** we need to get production and consumers working hand-in-hand to achieve demand reduction by supporting the consumer to make healthier choices.
- **Luke Spadavecchia:** leaving the EU presents an opportunity to do better in the future, as a lot of the core decisions in the past have had to be made in the context of the CAP.
- **Indra Thillainathan:** we need to go beyond the current approach. Environmental Land Management (ELM) plan from Defra is good, but we need other incentives and policies to deliver the emissions reductions we need.
- **Robin Fears:** across the board we need better evidence-based regulation and innovation. There is a central role for trans-disciplinary science to inform innovation.
- **Tim Benton:** climate change and environmental degradation are the biggest examples of market failure. We need regulation to internalise the externalities to make sure the market doesn't fail.

There is such a crossover between a sustainable diet and a healthy diet that if people eat healthily, they will eat more sustainably.

- **Ceris Jones:** farm profitability is important for the long-term investment required for the challenges ahead. We need integration and harmonisation of policy, so farmers get long term and consistent signals.
- **Richard Bramley:** I hope I have highlighted some of the frustrations that we farmers have. This is a city of 9 million people that needs 100,000 farmers delivering more than just food, but this comes down to making the market work. I have adopted many environmental measures on my farm, but I get zero reflection in the market place for the environmental benefits delivered. If we want these measures to be taken up everywhere, then we will need to reform the system to make it work. Farmers are naturally competitive with each other, and if there was an accounting system to measure against neighbours' performance, it would create internal competition. If the market place rewarded farmers, then the rural economy would drive the changes needed.

The **Chair (Lord Teverson)** closed the event by noting that agriculture is one of the most complex areas of climate change policy and the most difficult to tackle.