

**Written evidence submitted by Professor Neil Ward, University of East Anglia, Professor Tim Benton, Chatham House, Professor Sarah Bridle, University of York, Professor Stefan Kepinski, University of Leeds, Dr Angelina Sanderson Bellamy, University of the West of England.**

## Introduction

- 1 Climate change needs to become a much more central consideration in questions about the agri-food system and UK food security. Although agriculture contributes around 10 per cent of UK greenhouse gas emissions, when considered within the wider agri-food system including food processing and retailing, emissions amount to almost a quarter of the UK total. As decarbonisation of electricity generation and surface transport progress in the UK, so the agri-food system will loom larger as a source of greenhouse gas emissions. In addition, over the coming years and decades, the functioning of the agri-food system will become increasingly affected by climate change which will alter cropping patterns and bring new risks. The agri-food system therefore needs to be a central feature of our approaches to both climate change adaptation and mitigation. This is not yet sufficiently so.
- 2 The UK and its constituent parts require a stronger strategic approach to managing the agri-food system and rural land. This should involve a clearer articulation of the synergies and balance to be struck between the supply of healthy and affordable food, addressing climate change and other environmental problems, and promoting public health. The UK's poor diet is a major public health challenge. Over the coming decades, it will have serious implications for the UK population's wellbeing and quality of life, as well as for the National Health Service and public finances. In addition to the climate challenge, agricultural pollution continues to be a key contributor to poor water quality, a situation that has endured for several decades. Public health, environmental sustainability and emissions reduction are crucially important considerations that need to be much more fully brought to bear on discussions about UK food supply, food security and land use.
- 3 We convene UK Research and Innovation (UKRI)'s new Network+ on the development of a sustainable agri-food system for the net zero transition.<sup>1</sup> Neil Ward is based at the School of Environmental Sciences at the University of East Anglia and author of *Net Zero, Food and Farming: Climate Change and the UK Agri-Food System* (August 2022). Tim Benton is Director of the Environment and Society Programme at Chatham House. Sarah Bridle is Professor of Food, Climate and Society at the University of York and author of *Food and Climate Change: Without the Hot Air* (2020). Stefan Kepinski is Head of the School of Biology and Associate Director for Agriculture and Environment in the Global Food and Environment Institute at the University of Leeds. Angelina Sanderson Bellamy is Associate Professor of Food Systems at the University of the West of England. This submission is in our personal capacities and should not be taken as an official statement of UKRI.

### **Climate change and food security: projected effect, risks, and mitigation**

- *What are the main risks posed to future UK food security from projected climate change and biodiversity loss pathways?*

---

<sup>1</sup> <https://www.ukri.org/news/research-network-to-help-uk-agri-food-industry-reach-net-zero/>

4. Climate change will bring more extreme weather events which will disrupt agricultural production and potentially the operation of supply chains. Geopolitical instability in key commodity-producing regions such as Russia and Ukraine poses a risk to food security, principally through its impact on food commodity and input prices. Agricultural productivity depends upon biodiversity, with more than three-quarters of leading global food crops depending on pollination by animals.<sup>2</sup>
  - *Where does the UK's food come from? On the current climate change trajectory, how will these regions be affected by climate change and what will the impact on UK food security be?*
5. The UK imported 46 per cent of its food in 2020 but is approximately 75 per cent self-sufficient in temperate foodstuffs.<sup>3</sup> Those temperate foods that are imported come from our closest geographical neighbours, while fresh fruit and salad produce come mostly from Spain and Italy.<sup>4</sup> By value, most food imports come from the Netherlands, Germany, Ireland, France, Spain and Italy, sources which have been generally stable over recent decades. Overall, almost two fifths of food imports (by value) came from four EU Member States (Netherlands, Ireland, Germany and France) in 2020.<sup>5</sup> Climate change is likely to impact most markedly on Mediterranean areas. Warming in that region is already greater than the global average, and water stresses are likely to increase over the coming two or three decades. Over the medium to longer term, it is possible that supplies of fresh fruit and salad crops from southern Europe will come under pressure. However, this may be mitigated by moves to develop more farming under glasshouses elsewhere.
  - *How do existing UK food production, import, and export practices contribute to climate change and biodiversity loss?*
6. UK food production has had a major impact on biodiversity. Between the 1950s and 1980s, most lowland herb-rich and chalk and limestone grasslands were lost, as well as half of limestone pavements, ancient woodlands, and lowland fens and marshes, over 60 per cent of lowland raised bogs, and a third of all upland grasslands, heaths and mires.<sup>6</sup> This was accompanied by an appreciable decline in farmland birds, which has continued since the 1980s despite the development of agri-environmental policies aimed at halting the decline. Since 1970, there has been a 60 per cent decline in the abundance of priority species in the UK<sup>7</sup> and agricultural practices remain one of the most significant drivers of biodiversity decline in the UK.<sup>8</sup>
7. The agri-food system contributes almost a quarter of the UK's greenhouse gas emissions. Of the emissions from food production, methane from the UK livestock industry is the most significant. Much attention has been focused on

---

<sup>2</sup> Defra (2021) *UK Food Security Report 2021*. London: Defra, p.13.

<sup>3</sup> Defra (2021), p.11.

<sup>4</sup> Defra (2021), pp.91-93.

<sup>5</sup> Defra (2021), p.93.

<sup>6</sup> Nature Conservancy Council (1984) *Nature Conservation in Great Britain*. London: NCC

<sup>7</sup> House of Commons Environmental Audit Committee (2021) *Biodiversity in the UK: Boom or Bust?* London: Stationary Office, p.25.

<sup>8</sup> House of Commons Environmental Audit Committee (2021), p.30

enteric fermentation by ruminant farm animals. There has been less emphasis on emissions to air from slurry storage and manure management on farms although this is a concern.

8. Agricultural production has become increasingly specialised since the Second World War and concentrated onto a smaller number of larger farms. Intensive livestock production, heavily dependent upon animal feedstuffs, has meant that a significant proportion of farmland is used for grazing animals or for growing arable crops to feed them. The nation's dietary needs could be met, if livestock production was developed along more sustainable lines, with an emphasis on pasture-based grazing and a reduced need for land to grow other animal feeds. The British diet is a driver of the environmental pressures and impacts arising from the current agri-food system and is key to reducing pressures and helping support the transition to a net zero UK by 2050.
  - *How self-sufficient is the UK in producing food? What practices could the UK adopt to become more self-sufficient while reducing the emissions associated with agriculture?*
9. The UK is approximately 75 per cent self-sufficient in temperate foodstuffs. This has been a stable figure during the twenty-first century but fluctuated considerably during the twentieth century. From 1914 to 1939, the UK produced only around a third of the food it consumed.<sup>9</sup> By January 1943 food imports had fallen by 75 per cent on pre-war levels and there was a national mission to raise domestic production.<sup>10</sup> Levels of self-sufficiency in temperate food products rose from 67 per cent in the early 1970s to a peak of 83 per cent in the mid-1980s, when the Common Agricultural Policy was fuelling high levels of agricultural production and generating problems of surpluses.<sup>11</sup>
10. Self-sufficiency is a function of diet, and if diet was more focussed on temperate foodstuffs, this could potentially increase self-sufficiency. The UK could seek to produce more fruit, vegetables and salad crops, for example, including through new vertical and indoor farming techniques, and re-incentivising the production of tree crops (e.g. apples, pears, nuts).
11. Because livestock are a major contributor of emissions, a central concern needs to be reducing methane emissions from beef and dairy farms. This should focus not only on measures to reduce emissions from enteric fermentation (through animal breeding or feeds and additives, for example), but also on the direct emissions of methane from slurry storage and handling. Fewer livestock numbers would also reduce emissions, but domestic production must not be replaced by high-emission imports.

### **UK preparedness: Government and market**

- *What is the Government doing to prepare for disruption to the UK's food supply resulting from climate change impacts or biodiversity loss?*

---

<sup>9</sup> Murray, K. (1955) *Agriculture - History of the Second World War Series*. London: HMSO, p.5 & p.27.

<sup>10</sup> Murray, K. (1955), p.340.

<sup>11</sup> Marks, H. and Britton, D. (1989) *A Hundred Years of British Food and Farming – A Statistical Survey*. London: Taylor and Francis, p.121.

12. The National Adaptation Programme (NAP) is the Government's framework for planning how to adapt to climate change. The second programme (NAP2) covers the period 2018-22 and a third NAP (NAP3) will run from 2023 to 2028. A new UK Climate Change Risk Assessment was produced in January 2022 and Defra have begun work on updating its Climate Adaptation Research and Innovation Framework (CARIF) to support the objectives of NAP3. The next NAP will need to consider the implications of expected climate change on the operation of the agri-food system and for the strategic priorities around the management of the national land resource.
  - *Does the Government's Food Strategy address the risks of climate change and biodiversity loss adequately? Does it prepare the UK to adapt to a world affected by ecological crises?*
13. We agree with the criticism made by the independent statutory Climate Change Committee which argued that the Government's Food Strategy was a missed opportunity to tackle greenhouse gas emissions from agriculture, land use and food production. The UN and IPCC have been clear that the 2020s is a critical decade in which measures must be put in place to sufficiently reduce emissions in line with the Paris Agreement requirements. We are almost a third of the way through that decade and the UK agri-food system and land use still lacks a clear and appropriate strategy. The seriousness and urgency of the challenge are not matched by action.
  - *Could the UK's land be better used to secure our domestic food supply? What role could community or urban food growing play in increasing the UK's resilience to food shortages caused by environmental change?*
14. The UK's land resource is facing a set of strategic pressures more acute than at any time in the last 70 years. We will need to plant around 1,000,000 hectares of land with trees and the current proposed pathway to net zero assumes some contribution to carbon capture and storage through biomass energy crops. The Climate Change Committee also assumes some growth in developed land such that agricultural land will fall by almost a quarter by 2050. From the perspective of feeding the nation a healthy diet within environmental constraints, the current pattern of land use is very inefficient. For example, almost 2 million hectares of arable land are used to grow cereals for animal feed in the UK.<sup>12</sup> This undermines food security as well as public health and opportunities to mitigate climate change. The urgency of the climate challenge means that over the coming years particular agricultural practices and farming systems will have to adapt in support of the strategic optimisation of the national land resource.
15. Recent research by Lancaster University has found considerable capacity for producing food in urban-based systems, with yields comparable to rural sites.<sup>13</sup> This opportunity requires more strategic planning within the UK.
  - *What role should the Government take in ensuring that land is available to secure the UK's food supply in the context of a changing climate?*

---

<sup>12</sup> WWF (2022) *The Future of Feed* <https://www.wwf.org.uk/learn/low-opportunity-cost-feed>

<sup>13</sup> Payen, F. T., et al. (2022). How much food can we grow in urban areas? Food production and crop yields of urban agriculture: A meta-analysis. *Earth's Future*, 10, e2022EF002748.

16. Optimising the use of UK land needs to be considered from the perspective of climate change mitigation first. Given reduced land available for agriculture, a second question then becomes what would be the optimal pattern of cropping and land use to deliver healthy and sustainable diets for the British population. The Government needs to take a much more active and strategic role, given the vital strategic importance of the threats being mitigated. The climate change challenge is akin to the food security threat during the Second World War. At that time, active planning by Government helped effect a massive shift in land utilisation and productivity in food production.

### **Securing a sustainable food supply**

- *Does the Government's Food Strategy put the UK on a path to a secure and sustainable food supply?*
17. The Government's Food Strategy commits that domestic food production levels should be broadly maintained and not allowed to deteriorate. This is a welcome guide and, alongside the commitment to a net zero UK by 2050, provides some strategic clarity in facing the trade-offs and dilemmas around land use, climate mitigation and adaptation and agricultural support. Currently, of greater concern than where food comes from is the level of greenhouse gas emissions from food production and the agri-food system.
  18. Other than the serious problem of greenhouse gas emissions, agricultural pollution is still a significant contributor to poor water quality in rivers and groundwaters. This is despite the significant efforts to address agricultural pollution in the aftermath of the 1989 Water Act, which introduced much more stringent fines for pollution and technical standards for pollution control facilities, as well as free advice and capital grants. It is a travesty of British agri-environmental policy that more than 30 years on, agriculture continues to pose such serious and extensive problems for the water environment.
- *What are the most environmentally friendly ways of producing a secure supply of nutritious food?*
19. The most serious pressures on the global environment from UK agriculture come from methane emissions from livestock and nitrous oxide emissions from the application of manufactured fertilisers. A secure supply of nutritious foods would benefit from a planned move away from the current heavy reliance on red meats and highly processed foods, and with a greater emphasis on fruit, vegetables, beans and pulses in our diets. Agroecological mixed horticultural systems can be environmentally beneficial but access to land is a constraining factor.
- *What role could a reduction in meat and dairy consumption play in improving food security and what measures could the Government take to capitalise on the trend to plant-based diets?*
20. A significant proportion of arable farmland is taken up with growing animal feedstuffs and this is probably the single biggest problem in addressing the UK's greenhouse gas emissions from the agri-food system. It is not necessary for meat and dairy to be eradicated from our diet, but it is widely recognised by objective scientific opinion that consumption levels need to be reduced by at least around a third. Reduced consumption of meat and dairy products would help improve public health as well as deliver greenhouse gas

emissions mitigation, assuming that exports of meat and dairy do not simply increase. The experience of the Sugar Levy has shown that regulatory intervention can be a successful stimulus to innovation in food supply chains which benefits public health. The plant-based content of foods served in schools and other public sector outlets could be better encouraged. Dietary change is an essential part of the transition to a sustainable agri-food system that brings emissions within safe limits, and it is a serious abdication of responsibility for public authorities to dodge this question.

- *What role do food technologies have in mitigating the risks that environmental changes poses to UK food security?*
21. There has been considerable investment in novel food products such as plant-based proteins and lab-cultured meat. It is vital to judge the potential of innovations by their contribution to net emissions reduction. The value of novel foods needs to be assessed in terms of the reduced need for land for food production and reduced net emissions. A full life-cycle analysis should be the basis on which any claimed climate change benefits from novel foods are measured. However, we would urge that a far wider range of innovation is needed than simply food technology to deliver a better food system. Innovation can help in, for example, medical applications to help citizens eat more healthily, financial instruments to ensure markets work better, and retail technology to guide better consumption patterns. Innovation is also needed in governance (e.g. regulation and trade rules) and institutionally.
- *Is there research and development the Government could be funding to provide food security solutions?*
22. The UK has world-leading scientific research in agriculture, food, environmental sciences. It is crucial that research is better co-ordinated across scientific disciplines and across the remits of the respective research councils within UKRI. It is also recognised that the interface between basic research, applied research, knowledge exchange intermediaries and frontline companies such as farms could be stronger and better co-ordinated.<sup>14</sup> The Network+ model, developed by the research councils, provides a useful framework for ensuring cross-disciplinary dialogue and joint-working among scientific researchers and in close collaboration with businesses and other stakeholders. Our AgriFood4NetZero Network+ is one example, and similar exercises could be developed to focus on food security solutions.

## Conclusion

23. The UK's level of food self-sufficiency is a function of diet. If the balance between meat, on the one hand, and cereals, fruit and vegetables, on the other, were to alter in favour of the latter, then less land would be required to grow crops to feed farm animals and more land could more efficiently and effectively be utilised to meet the calorific needs for human consumption. Such a shift would also improve human health outcomes and reduce the significant and growing spend on the treatment of non-communicable diseases within the health service. During the Second World War, a national approach to food and land meant that dietary needs could be better met from

---

<sup>14</sup> Lowenberg-DeBoer, J. *et al.* (2022) *Application of Science to Realise the Potential of the Agricultural Transition*. Harper Adams University and Food & Farming Futures.

national agricultural resources despite a high degree of dependence upon food imports at the outbreak of war. Food security and its implications for land use need to be considered in the context of dietary patterns of demand and our vitally important commitments to address climate change.

*December 2022*