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Environmental change and food security

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Environmental Audit Committee

The Environmental Audit Committee is appointed by the House of Commons to consider to what extent the policies and programmes of government departments and non-departmental public bodies contribute to environmental protection and sustainable development; to audit their performance against such targets as may be set for them by His Majesty's Ministers; and to report thereon to the House.

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Summary

Climate change and biodiversity loss affect the quantity and quality of food produced both in the UK and across the world. British people have already started to see the effects of that on their dinner plates: 2022's summer heatwave diminished the yields of certain British crops, while extreme weather in Spain and Morocco earlier this year caused empty shelves for some fruits and vegetables. The impacts of environmental change also coincide with those of other crises, such as the Covid-19 pandemic and Russia's invasion of Ukraine, to place further stress on the global food system.

While environmental change threatens to weaken food security on the one hand, on the other, the food system is one of the biggest drivers of climate change and nature loss, exacerbating the very environmental factors that threaten to undermine the food system. As a result of our investigation, we frame our findings around three core pillars:

a) Climate change and biodiversity loss are taking place, but we can and must respond to them. **We need to adapt our food and farming system to become more resilient to the effects of climate change and biodiversity loss**.

b) If the global rise in temperatures does not slow down, extreme weather will become more frequent, further undermining food security, and requiring yet more adaptation. Achieving food security goes hand in hand with achieving net zero and biodiversity targets. **We must mitigate the impacts of climate change and biodiversity loss on our food system.**

c) The way we currently produce our food globally is one of the most significant causes of climate change and biodiversity loss, compounding the problem in a vicious cycle. **We must mitigate the damage to the environment that aspects of our food system cause**.

In this inquiry we focus on food security in terms of the UK's ability to provide enough food for its population, in a sustainable way. Currently, the UK imports around 42% of its food, and produces 58% domestically. Self-sufficiency is an important part of food security: many of the countries from which the UK imports food are at risk of the effects of climate change, potentially jeopardising supply in the future. The UK particularly depends on imports for certain categories including fruit and vegetables, so we especially encourage steps to improve the UK's self-sufficiency in those areas where environmentally and financially viable. However, the UK's food security is inseparable from the global food system. To rely on domestic production alone would increase the UK's vulnerability to extreme weather events in the UK, and even food produced at home depends on a wide range of imports from abroad including animal feed and fertilisers.

The food system both globally and in the UK has become too concentrated and too driven by price alone. It rang loud and clear throughout our inquiry that the Government and the food sector must focus on embedding more diversity of produce and farming methods within the food system, both to build resilience against the effects of environmental change and to reduce the food system's own impact on the planet.

In light of our three pillars; the inseparability of the UK's food system from the global system; and the imperative to introduce more diversity and resilience, we summarise our most important recommendations to the UK Government to keep Britain nourished while protecting the planet:

1. Since the UK's food security depends on some degree of imports, it is vital that environmental harms are not exported abroad by allowing the importation of food that is produced to lower environmental standards. **The Government should uphold standards for the environmental impacts of food production in its trading relationships with other countries**.

2. The Department for Environment, Food and Rural Affairs collaborates with other Government departments and with industry on food security issues, but it was clear from our evidence that this work is neither sufficiently co-ordinated nor long-term. **We recommend that the Government establish a cross-government, cross-sector food security body to bring together all the actors in the food system to examine and make policy recommendations on long-term food resilience and environmental issues.**

3. The Government has committed in statute to publishing an assessment of UK food security once every three years. While that is welcome, we recommend that due to increasing volatility in food supplies, caused by extreme weather as well as recent geopolitical and health crises, **the Government should publish its food security report annually**.

4. Preventing and reducing food waste at all stages in the food chain would be a quick-win for the Government and should be a central component of the Government's strategy for maintaining food security in the face of environmental change. **We recommend that the Government publish a strategy for preventing and reducing waste in the food system**.

5. The agricultural sector is crying out for a common standard for baseline metrics so that progress towards food sustainability can be accurately measured and compared. We welcome the progress that the Government is making towards establishing baseline food sustainability metrics and methodologies, but the sector needs more clarity about what is coming down the tracks and when. **We recommend that the Government list all the areas in which it intends to establish baseline metrics and tools for food sustainability, which we think should include soil health, carbon sequestration, biodiversity net gain, and carbon credits.**

6. Soils are a victim of the more extreme weather events caused by climate change. But healthy, resilient soils are critical to the UK's food security. **The Government must publish much more detailed advice on soil health, including guidelines for farmers on how they may accurately and affordably measure key environmental indicators in their soils such as carbon and biodiversity.**

7. Water management on farms is going to become increasingly important as the climate changes. Using water more efficiently and storing it for use during droughts, as well as managing demand overall, is going to be critical. To achieve these aims, the Government should develop policies to **transport water more easily and quickly**

between regions across the UK; roll out precision irrigation technology across the UK farming system; and publish an implementation plan to meet the target of increasing water storage on farms by two thirds by 2050. In rolling out precision irrigation technology, the Government should mitigate against efficiency paradoxes and report on the impact on water usage.

8. The Government committed, in its food strategy in June 2022, to publishing a Land Use Framework, to provide a set of principles for decision-making to ensure that English land performs the many functions required of it. It was clear from our evidence that the Land Use Framework will be a critical lever in determining whether the UK will achieve the three pillars set out in our report. The Government has committed to publishing the framework this year: that deadline is fast approaching. **We expect the Government to publish its Land Use Framework no later than the last sitting day in December 2023, and recommend that it must fully integrate food security as a central principle. It must evidence how the Government's goal of improving productivity within existing uses can be achieved without negative environmental impacts; and provide its methodologies for calculating how the objectives of enhancing food security and meeting the Government's targets on net zero and biodiversity will be met.**

9. The Government does not want to tell people what to eat, but from its approach to healthy eating it clearly understands its role in helping people to make better choices. In any case, if the Government will not tell people what to eat, the advertising industry will: we heard that for every £5 spent on public health education, £200 is spent on junk food ads. The Climate Change Committee is clear in its advice that across the country meat and dairy consumption should reduce by 20% by 2030 and by 35% by 2050 in order to achieve the Government's net zero target. There is plenty that the Government can do to encourage sustainable diets without being prescriptive. **We recommend that the Government should set a target for half of public money spent on food to be produced within the local area or to higher environmental standards; publish national guidance on sustainable diets; and include within the school curriculum science-based education about the environmental impacts of food production.**

10. The Environmental Land Management schemes are another vital opportunity to adapt the UK food system to the effects of environmental change and minimise the environmental impacts of the food system. The schemes are based on the principle of public money for public goods, but the Government takes for granted that food security is a public good. We think this is not good enough. **We recommend that the Government designate food security as a public good and incorporate food security and environmental goals more explicitly in the design of Environmental Land Management schemes.**

11. To achieve the diversity needed for a resilient food system, the UK must produce food through a variety of different farming methods spanning a spectrum from a return to more traditional methods, to agroecology, to the latest in cutting edge technology. **We recommend that the Government publish its priorities for agricultural innovation research and development—referring to the list we compiled from the extensive evidence we received—to provide clarity for researchers, industry, and investors.**

12. New food technologies are an exciting area which can help to reduce the environmental impacts of food production and grow foods domestically for which the UK currently over-relies on imports. However, the point is defeated if the emissions associated with new technologies outweigh the environmental cost of importing the same product. **We recommend that the Government publish a strategy for technological innovation in food production, to include trials, understanding emissions, regulation, and making new technologies accessible to small farmers.**

13. Finally, and perhaps most importantly, for farmers to transition their businesses to the most environmentally friendly practices, their options need to be commercially viable and they must have access to high-quality, locally tailored support and advice. **We recommend that the Government ensures that small famers have access to advisory services that are free to use; monitors take up of advice services by farms of all sizes; and co-designs with farmers support mechanisms to incentivise the take-up of technological innovations in food production.**

Introduction

Our inquiry

1. British people are already starting to see the effects of environmental change on our dinner plates. Earlier this year, shoppers faced empty shelves at the supermarket and caps on purchases of popular fruits and vegetables due to unusually cold weather in Spain and floods in Morocco.[1] Home-grown food has been affected too: the heatwave and drought in summer 2022 caused lower yields of some British crops.[2] The risks to food security caused by environmental change—a combination of a changing climate and loss of biodiversity—have long been recognised.[3] Concerned by recent shocks to the UK's food system, we decided to examine how well prepared our nation is to keep food supplies secure as the environment at home and around the world continues to change.

2. We launched our inquiry in November 2022 with terms of reference spanning the projected effects of environmental change on food security; the UK's readiness; and securing a sustainable food supply. Nearly sixty organisations and individuals contributed written submissions. We held five oral evidence sessions, hearing from academics, food producers, retailers, and current and former independent advisers to the Government including the Climate Change Committee and Henry Dimbleby, founder of the food chain Leon and author of the recent independent review into the UK food system.[4] In our final session we took evidence from Rt Hon Mark Spencer MP, Minister for Farming, Food and Fisheries at the Department for the Environment, Food and Rural Affairs (Defra). We are grateful to all who took the time to contribute to our inquiry and inform our findings. We wish also to place on the record our thanks to the staff at Kew's Wakehurst Place in Sussex and the National Trust's Wimpole Estate in Cambridgeshire, where members of the Committee were generously hosted on fascinating visits that brought to life the issues covered by our inquiry.

What is food security?

3. Given that there are over two hundred definitions of 'food security', we would do well to explain from the outset how we are using the term in this inquiry.[5] Henry Dimbleby explained that definitions range from having complete choice of foodstuffs all year round—"whether everyone can buy an avocado on Christmas day"—to so-called "U-boat food security", whereby, "if cut off completely from any global trade", the population could feed itself entirely from British land.[6] In this inquiry we have chosen to focus on the ability of this country to provide, at a national level, enough food for its population—not necessarily through British-grown produce alone, but through a combination of domestic and imported produce, in a sustainable way.[7] We will, however, explore the important

1 "Why is there a shortage of tomatoes and other fruit and vegetables in the UK?", BBC, 24 February 2023
2 "UK farmers count cost as heatwave kills fruit and vegetable crops", The Guardian, 1 August 2022
3 E.g. Government Office for Science, Foresight International Dimensions of Climate Change, 2011; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, The Global Assessment Report on Biodiversity and Ecosystem Services, 2019
4 Defra, National food strategy for England, published 29 July 2020
5 Q119 [Henry Dimbleby]
6 Q119 [Henry Dimbleby]
7 In recent years, the Food and Agriculture Organisation of the United Nations has recognised that "it is vital to incorporate sustainability into the concept of food security". FAO, Food security and nutrition: building a global narrative towards 2030, 2020, p 9

topic of self-sufficiency. We are pleased that the Environment, Food and Rural Affairs (EFRA) Committee investigated household food security and challenges with the cost of living as part of its recent report on food security; we hope that our findings on the environmental change aspects will complement our sister Committee's findings.[8] We also accept the challenge of our witness George Monbiot, writer and environmental activist, that our inquiry was too focused on "our national situation".[9] While our remit is to make recommendations to the UK Government, we have also sought to set our findings in the context of the global picture.

How climate change affects food security

4. Research on how environmental change affects food security both nationally and globally is substantial.[10] Through the evidence we received, we provide here not a comprehensive scientific treatise on the subject, but an overview of what we learned about the impacts on food security—current and expected—first of climate change and second of biodiversity loss.

5. Beginning at home: as we have already mentioned, the recent extreme weather last year affected the yield, the growth, and the quality of numerous crops. Some crops such as cereals and oilseed rape thrived, while others such as broccoli and cauliflower struggled.[11] To give a specific example, the volume of potatoes produced by McCain's growers last year was 15% below their contracts; a trend that the company's Vice President of Agriculture said was "happening more regularly now".[12] Last year's drought also desiccated soils, making it harder for crops to thrive, and leading to stunted fruits and vegetables being rejected by retailers.[13] The drought also affected livestock farming, with some farmers having to "cut stock numbers due to low levels of grass growth".[14]

6. The effects of extreme weather were not only realised in the produce itself, but also rippled throughout the food supply system. Chris Brown, Senior Director for Sustainable Supply Chains at Asda, told us how most fridges in the farming system, including at Asda, are designed to tolerate temperatures only up to the mid-30s degrees, not the 40-degree heat that parts of Britain experienced for the first time last year; the influx of fans that were installed on dairy farms put up farmers' energy costs too.[15] The shrivelled grass meant that many livestock farmers had to resort to bought feed—another additional cost.[16]

7. Climate change affects food produced in water as well as that produced on land. Rising ocean temperatures are expected to restrict the size and movement of fish, and may cause so-called 'thermal bottlenecks' which can "prevent reproduction, causing populations to crash".[17] Fish species around the British Isles are already responding to warming by changing their distribution and abundance, moving northwards to cooler

8 EFRA Committee, Seventh Report of Session 2022–23, Food security, HC 622
9 Q189
10 For syntheses conducted by the Houses of Parliament see e.g.: *Climate Change and Agriculture*, POSTNote 600, May 2019; Impact of climate change and biodiversity loss on food security, In Focus, House of Lords Library, 1 September 2022.
11 Defra (ECFS0022); Mrs Emma Sturdy (Farmers Wife at JO & RW Sturdy) (ECFS0016)
12 Q68 [James Young]
13 E.g. Sustain: the alliance for better food and farming (ECFS0047)
14 National Sheep Association (ECFS0011)
15 Q167
16 Q149 [Minette Batters]; Landworkers' Alliance - Farmers Union (ECFS0017)
17 Blue Marine Foundation (ECFS0007)

waters.[18] Climate change is also expected to increase levels of acidity in oceans and reduce water circulation in the North Sea, reducing its salinity.[19] Both of these changes would affect the habitats and development of marine species, including their ability to develop shells and skeletons.[20]

8. As is well documented, temperatures are expected to continue to rise, and extreme weather in the UK is set to become more frequent: the Met Office predicts that summers will be 60% drier and winters 30% wetter by 2070.[21] In 2023 the UK experienced the hottest June and joint-hottest September on record.[22] Hotter temperatures could lead to very different outputs: it may boost yields for some crops,[23] while causing yield losses for others such as British potatoes, wheat, barley, onions, and carrots.[24] The National Sheep Association warned that "future climate volatility and uncertainty" will affect the availability of animal feed,[25] while others pointed out that elevated CO_2 levels and temperatures can reduce the nutritional content of some staple crops.[26]

9. Judicaelle Hammond, Director of Policy and Advice at the Country Land and Business Association, pointed out that farmers will have to contend with an increased risk of flooding owing to rising sea levels;[27] which can cause crops to fail due to water-logged soil or contaminated flood water.[28] Extreme wind can also damage infrastructure and crops.[29] Baroness Brown, Chair of the Climate Change Committee's sub-committee on adaptation, also explained that the little summer rainfall the UK will experience will be "very intense tropical rainfall", skimming off the surface of the soils and degrading them.[30] We also heard that the effects of climate change will be felt differently across the UK, for example, the east and south-east will be warmer and drier, and therefore "particularly stressed for water", while wetter winters in the west will require farmers to deal with "inundation of fields and crops with water".[31]

18 Blue Marine Foundation (ECFS0007); The National Federation of Fishermen's Organisations (ECFS0043)
19 Blue Marine Foundation (ECFS0007)
20 The National Federation of Fishermen's Organisations (ECFS0043)
21 Met Office, Effects of climate change
22 "Climate change impacts June temperature records", Met Office, 3 July 2023; "Joint-warmest September on record for UK", Met Office, 2 October 2023
23 Q120 [Henry Dimbleby]; Mr James Heyburn (Policy and Engagement Officer at Imperial Policy Forum); Dr Ana Mijic (Director, Centre for Systems Engineering and Innovation at Imperial College London); Dr Athanasios Paschalis (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering at Imperial College London); Ms Elizabeth Fonseca (Research Postgraduate, Centre for Environmental Policy at Imperial College London) (ECFS0012)
24 Q4 [Baroness Brown]; cf. Mr James Heyburn (Policy and Engagement Officer at Imperial Policy Forum); Dr Ana Mijic (Director, Centre for Systems Engineering and Innovation at Imperial College London); Dr Athanasios Paschalis (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering at Imperial College London); Ms Elizabeth Fonseca (Research Postgraduate, Centre for Environmental Policy at Imperial College London) (ECFS0012)
25 National Sheep Association (ECFS0011)
26 National Farmers' Union (ECFS0020); The Country Land and Business Association (ECFS0042); Grantham Research Institute on Climate Change and the Environment (ECFS0054); George Monbiot (Journalist and Author) (ECFS0070)
27 Q224
28 Landworkers' Alliance - Farmers Union (ECFS0017)
29 Landworkers' Alliance - Farmers Union (ECFS0017)
30 Q2
31 Q12 [Richard Millar]; Mr James Heyburn (Policy and Engagement Officer at Imperial Policy Forum); Dr Ana Mijic (Director, Centre for Systems Engineering and Innovation at Imperial College London); Dr Athanasios Paschalis (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering at Imperial College London); Ms Elizabeth Fonseca (Research Postgraduate, Centre for Environmental Policy at Imperial College London) (ECFS0012)

10. Climate change of course also affects the food the UK imports from abroad, as well as global supply chains. Heatwaves and drought throughout Europe last year led to lower wheat and maize yields.[32] If global temperatures were to rise by 2.5°C, "wheat will increase in productivity in the northern hemisphere… and maize and rice in the equatorial zones and the south will decrease".[33] A temperature increase of just 1°C, we were told, could "dry out 32% of the planet's land surface";[34] and if sea levels rose by one metre, "half the [Mekong] delta"—the largest exporter of rice—"will be underwater".[35] An increase in both droughts and flooding risks destroying farms, crops, and animals through fires and drowning.[36]

11. Again, the impacts are felt throughout the system: more extreme hot and cold temperatures can make working conditions unsafe and affect animal welfare; frequent extreme weather events such as flooding can disrupt international transport links; and the need for more refrigeration and fans in the food system creates more emissions, exacerbating the climate change that creates the need for cooling in the first place.[37] Severe weather abroad can lead to price rises for imported items: Baroness Brown gave the example of up to 132% price hikes for vegetables imported from Europe during severe weather in 2016 and 2017, and recent research found that climate change induced extreme weather is likely to account for one-third of food price inflation experienced in the UK in 2023.[38] It can also lead to export bans as countries seek to protect their national stores.[39] George Monbiot gave the example of India, which at first volunteered to become a "super exporter" of wheat after Russia invaded Ukraine, only months later to ban exports of wheat following a "huge heatwave".[40]

How biodiversity decline affects food security

12. Agriculture systems in the UK and globally are dependent on thriving populations of a wide variety of living organisms, such as insects that pollinate plants, and worms and bacteria that keep soils healthy. The fact that many organisms are declining in population, and even going extinct—what is known as "biodiversity loss" or "biodiversity decline"—is well documented, as are the repercussions for food security.[41] The Intergovernmental Panel on Climate Change (IPCC) has identified climate change as one of the drivers of biodiversity loss, so the impacts of both these phenomena on food security are interrelated.[42]

13. Dr Elizabeth Boakes, Research Fellow at the Centre for Biodiversity and Environment Research at University College London, explained to us that biodiversity loss affects "protection against pests and against natural disasters like hurricanes, floods, and so on". She added that "staple products we are used to having" come from countries "in which biodiversity will be most vulnerable to climate change". These products include: "rice

32 Q120 [Henry Dimbleby]
33 Q119 [Henry Dimbleby]
34 Q202 [George Monbiot]
35 Q119 [Henry Dimbleby]
36 George Monbiot (Journalist and Author) (ECFS0070)
37 Q2 [Baroness Brown]; Q24; [Baroness Brown]; The Met Office (ECFS0040); Sustain: the alliance for better food and farming (ECFS0047); George Monbiot (Journalist and Author) (ECFS0070)
38 Q4; Energy & Climate Intelligence Unit, Climate, Fossil Fuels and UK Food Prices, November 2023
39 Grantham Research Institute on Climate Change and the Environment (ECFS0054)
40 Q187
41 See e.g. IPBES, The global assessment report on biodiversity and ecosystem services, 2019; HMT, The Economics of Biodiversity: The Dasgupta Review, 2 February 2021
42 IPCC, Sixth Assessment Report. Fact sheet - Biodiversity, November 2022

from India, soy from Brazil, cocoa from Côte d'Ivoire, coffee from Indonesia and bananas from Costa Rica".[43] In addition to biodiversity loss, others highlighted the risk of rising temperatures giving rise to new pests, diseases, pathogens and invasive species in the UK which will threaten both plants and livestock.[44] Biodiversity loss affects domestic farming too: one study shows that a 30% decline in UK pollinator populations over 10 years would cost nearly £200 million a year in lost crop yield.[45]

How food production causes climate change and biodiversity decline

14. Throughout our inquiry, we learnt that food production is not only affected by climate change and biodiversity loss, but also contributes to these processes, driving the environmental factors that undermine food security. In the UK, farming makes up 0.5% of GDP but produces 12% of greenhouse gas emissions.[46] The food system globally is responsible for around 30% of carbon emissions and 50% of biodiversity loss.[47] This happens through processes such as grazing animals—nibbling up tree seedlings in their infancy—and laying fertiliser, which secretes chemicals into the soil and evaporates them into the wider environment; as well as the emissions produced by agricultural machinery, clearing land for pasture, and pre- and post-production processes: the list goes on.[48]

15. Marine farming, also known as aquaculture, plays its role in contributing to climate change and biodiversity loss too. The oceans "are the world's largest carbon sink", and overfishing reduces opportunities for storing carbon such as "when carbon absorbed by plankton and marine plants enters the food web".[49] We also heard that "overfishing and destructive practices have been the main cause of marine biodiversity loss for the last 40 years".[50] Another way that aquaculture causes emissions is through the use of fossil fuel-powered vessels.[51] We received mixed evidence on the impacts of bottom trawling. The Blue Marine Foundation, a charity focused on ocean health, argued that bottom trawling had contributed to the decline of UK landings of cod by 87%, hake by 95%, and halibut by 99.8% since the 1980s, and that trawling damages the seabed and causes biodiversity loss.[52] The National Federation of Fishermen's Organisations, on the other hand, suggested that the impacts of trawling on "sediment disturbance" were "overstated".[53]

16. Another way in which the food system contributes to climate change and biodiversity loss is through waste: food that is wasted on farms due to factors such as disease or overproduction; food that is wasted by households and by the retail sector, and other

43 Q44
44 Q28 [Baroness Brown]; National Farmers Union Scotland (ECFS0010); James Hutton Institute (ECFS0033)
45 Tom D. Breeze et al., "Pollinator monitoring more than pays for itself", Journal of Applied Ecology, vol 58, issue 1 (January 2021), pp 44–57
46 Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)
47 Q43 [Dr Monika Zurek]; Q80 [Guy Singh-Watson]; Q126 [Henry Dimbleby]; Jake Tadhunter (ECFS0001)
48 Q201 [George Monbiot]; Community Planning Alliance (ECFS0006); Mr James Heyburn (Policy and Engagement Officer at Imperial Policy Forum); Dr Ana Mijic (Director, Centre for Systems Engineering and Innovation at Imperial College London); Dr Athanasios Paschalis (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering at Imperial College London); Ms Elizabeth Fonseca (Research Postgraduate, Centre for Environmental Policy at Imperial College London) (ECFS0012); Nature Friendly Farming Network (ECFS0024); James Hutton Institute (ECFS0033)
49 Blue Marine Foundation (ECFS0007)
50 Blue Marine Foundation (ECFS0007)
51 Blue Marine Foundation (ECFS0007); The National Federation of Fishermen's Organisations (ECFS0043)
52 Blue Marine Foundation (ECFS0007)
53 The National Federation of Fishermen's Organisations (ECFS0043)

inputs that are sometimes wasted such as fertiliser, water, and energy.[54] Food waste sent to landfills emits greenhouse gases; while the other resources that have gone into producing the food are wasted when the food becomes food waste.[55]

17. There are other ways in which food production, including livestock farming, in fact fosters biodiversity, such as by providing habitats for pollinators and other organisms that contribute to healthy ecosystems.[56] So the picture is complicated, and also gives room for hope. Nevertheless, the global statistics show that food production is the second largest producer of carbon emissions and the biggest destructor of biodiversity globally; the livestock industry is also "the biggest source of anthropogenic methane on earth".[57] The catalogue of risks was succinctly summarised by our witness George Monbiot:

> Food production is the top cause of habitat destruction, wildlife loss, species extinction, soil degradation, fresh water use, land use and one of the top causes of climate breakdown, fresh water pollution and air pollution.[58]

These risks have the potential to be exacerbated by increases in the world's population: according to the World Resources Institute, there will be 3 billion more people to feed in 2050 compared to 2010, requiring a 56% increase in food.[59]

How environmental crises coincide with other crises to affect food security

18. The impacts of environmental change on the food system do not take place in a vacuum. The covid-19 pandemic; the recent surges in energy prices; Russia's invasion of Ukraine: all have placed stress on the production of food. The food system displayed its resilience in the way it withstood the pandemic: although there were some issues with sourcing workers, rerouting supply chains, and fluctuating prices, ultimately the pandemic did not have "the enormous impact that we might have expected" either in the UK or across the world.[60]

19. Russia's full-scale invasion of Ukraine, however, makes the pandemic "look insignificant": it has not only affected the supply and movement of ingredients such as wheat around the world; it has also increased farmers' fertiliser costs as the two countries are significant global suppliers of fertiliser.[61] The rise in energy prices makes many processes for producing food more expensive, such as growing vegetables in heated greenhouses and storing fruit in electricity-powered fridges.[62] Minette Betters, President of the National Farmers' Union, told us that since "many of food and farming's costs are driven by the price of gas", rising energy prices drive prices upwards across the board, such as "for feed materials, for fuel, and for energy in general".[63] Ms Batters added that

54 E.g. CCm Technologies (ECFS0002); Anaerobic Digestion and Bioresources Association (ADBA) (ECFS0038); Sustain: the alliance for better food and farming (ECFS0047)
55 University of Essex (ECFS0009)
56 Q225 [Judicaelle Hammond]
57 E.g. Q2 [Baroness Brown]; Q196 [George Monbiot]; Q212 [George Monbiot]
58 Q220
59 World Resources Institute, How to sustainably feed 10 billion people by 2050, in 21 charts, 5 December 2018
60 Defra (ECFS0022); Q189 [George Monbiot]; Q191 [Professor James Lowenberg-DeBoer]
61 Q34 [Dr Monika Zurek]; Qq147–148 [Minette Batters]
62 Q33 [Dr Monika Zurek]; Q35 [Dr Elizabeth Boakes]
63 Q147

"[t]hese costs are unprecedented in my lifetime", and led to the UK producing 1 billion fewer eggs in 2022 compared with 2019, as well as "the lowest level of tomatoes and cucumbers being produced since 1985".[64]

20. The UK food system's simultaneous resilience and vulnerability to multiple crises including global health and geopolitical crises was captured by Balwinder Dhoot, Director of Sustainability at the Food and Drink Federation:

> [T]he sector has been under intense pressure for a number of years. It has had shocks with the change of trading relationship with the EU, Covid, Russia-Ukraine and behind the scenes the food and drink manufacturing industry has carried on working, providing food, with people working in quite precarious situations particularly with Covid, and lots of challenges, but the sector is adaptable and has been able to make sure food is still on the table.
>
> That has reduced the resilience of the sector. Margins have gone down. We think 50% of investment decisions are being paused in the sector, because they are firefighting all the time.[65]

21. Our inquiry into the environmental change impacts on food security, then, sits in a context of attempting to improve the resilience of a system that faces challenges from a variety of sources. In its recent report on food security, the EFRA Committee looked closely at the geopolitical angle.[66] Again, our findings are intended to complement those of our sister committee.

An overview of relevant government policy

Government food strategy

22. In 2019, the Government commissioned Henry Dimbleby to conduct an independent review of England's food system to inform a national food strategy.[67] The Dimbleby review covered many aspects of the food system, including health, trade, the price of food, and advertising, as well as climate change and biodiversity. The review was published in two parts in 2020 and 2021.[68] The Government then published its food strategy for England in June 2022, which covers food security and sustainable production, healthier and sustainable eating, and the UK as part of a global food system.[69] Henry Dimbleby resigned from his position as a non-executive director at Defra in March 2023.[70]

UK food security report

23. In addition to its food strategy, the Government has numerous other policies, funds, and commitments that feed into the resilience of the UK's food system. The Agriculture Act 2020 committed the Government to assess UK food security at least once every three

64 Q147
65 Q74
66 EFRA Committee, Seventh Report of Session 2022–23, Food security, HC 622
67 Most policy to do with food is devolved, but the review team worked closely with devolved administrations.
68 Defra, National food strategy for England, published 29 July 2020
69 Defra, Government food strategy, 13 June 2022
70 "Food tsar quits in protest at failure to tackle obesity", The Sunday Times, 19 March 2023

years; the first of these assessments was published in 2021.[71] The assessment is an analysis of food security data—it does not itself contain policies but its purpose is to inform government policy.

Land Use Framework and Environmental Land Management schemes

24. Two other highly significant pieces of work are the Government's Land Use Framework and the Environmental Land Management schemes (ELMs). Henry Dimbleby recommended that the Government publish a Land Use Framework, and the Government committed in its food strategy to bring one forward in 2023. ELMs form part of the new farming funding framework following the UK's departure from the European Union's Common Agricultural Policy. The schemes pay farmers to deliver environmental improvements on their land. We will explore both the Land Use Framework and ELMs in later chapters.

25. Besides ELMs, other sources of funding include the £270 million Farming Innovation Programme, which invites applications for R&D projects that enable insights from science and business to be applied to challenges in agriculture and horticulture.[72] The £27 million Farming Investment Fund invites applications for projects that improve productivity and bring environmental benefits. Its scope it not limited to the environmental impacts of food production—for example, it also covers animal health and welfare—but relevant branches of the fund include grants for equipment, technology, and infrastructure for water management and slurry management.[73]

Other government policies

26. Other relevant work that Defra highlighted in its evidence includes: requiring English local authorities to develop local nature recovery strategies; rolling out mandatory biodiversity net gain requirements for developments; passing the Genetic Engineering (Precision Breeding) Act 2023; and collaborating with G20 and other countries on the Agricultural Market Information System to coordinate policy action on food commodity flows.[74] In addition, the Government has made overarching commitments to deliver net zero carbon emissions by 2050 and to halt biodiversity decline by 2030.

Three pillars to our findings

27. In spite of the stark warnings we received about the environmental impacts both on and of our food system, we were also struck by the opportunities for new technologies, industries, and innovation that we will explore further in this report. Based on the context set out above, our findings are framed by three overarching pillars:

a) Climate change and biodiversity loss are taking place, but we can and must respond to them. **We need to adapt our food and farming system to become more resilient to the effects of climate change and biodiversity loss**.

71 Agriculture Act 2020, Section 19; Defra, United Kingdom Food Security Report 2021, published 16 December 2021

72 Defra and UKRI, Farming Innovation: find out about funding

73 Rural Payments Energy, Farming Investment Fund, published 16 November 2021

74 Defra (ECFS0022)

b) If the global rise in temperatures does not slow down, extreme weather will become more frequent, further undermining food security, and requiring yet more adaptation.[75] Achieving food security goes hand in hand with achieving net zero and biodiversity targets. **We must mitigate the impacts of climate change and biodiversity loss on our food system.**

c) The way we currently produce our food is one of the most significant causes of climate change and biodiversity loss, compounding the problem in a vicious cycle. **We must mitigate the damage to the environment that aspects of our food system cause**.

Our report

28. We present our findings in five chapters. Chapter one takes a broad look at the UK food system and the Government's policy framework for environmental change and food security. In chapter two, we scrutinise available data and metrics on food sustainability and the Government's associated proposals. Chapter three explores two of the most important building blocks of the food system: soil and water. Chapter four focuses on the issue that many of our witnesses felt was the heart of the matter: land use. Finally, in chapter five we investigate a wide range of innovative food production practices to build deeper resilience into our food system.

75 Q8 [Richard Millar]; Q59 [Dr Elizabeth Boakes]

1 Understanding our food system and developing a policy framework

The UK food system

Food self-sufficiency

29. In 2022, the UK imported around 42% of its food, and produced 58% (see Figure 1).[76] The UK has become more self-sufficient over the last few decades: before the second world war, only 30% of food was domestically produced.[77] When it comes to the "U-boat" food security that Henry Dimbleby described (see paragraph 3), the UK is in a more comfortable position than many other countries. Mr Dimbleby compared the UK's situation to that of Egypt:

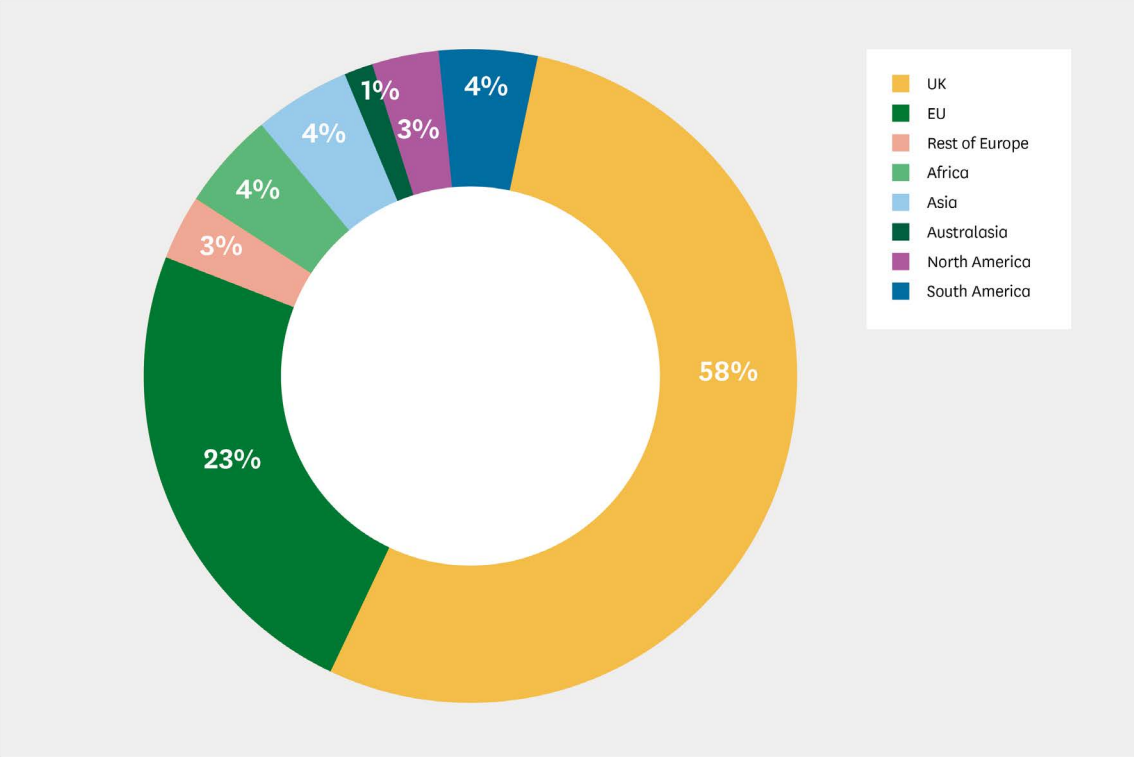
> Their land could feed only half of their population. Before the [Russia-Ukraine] war, they got 85% of their grain from Ukraine and Russia. They have food inflation of over 60%—they have just released the figures. So their Government clearly have what I would see as existential problems with food security …
>
> Although the wealth is spread very unequally, we are a very rich nation in comparison… We would have to have rationing; we would have to reduce the amount of meat that we ate and feed more of the crops to people, but we could do it. Being rich and smallish, there will be a lot of other countries that run out of that calorie food security before us.[78]

76 Latest available data from Defra, Food statistics in your pocket, updated 3 November 2023, Table 3.1: Origins of food consumed in the UK, 2022. It is often quoted that the UK produces 54% of its food. This is based on the UK Food Security Report, published in December 2021: Defra, UK Food Security Report 2021, 16 December 2021, p 86

77 Q119 [Henry Dimbleby]

78 Q119

Figure 1: The UK produces just over half its food. It imports just under half from the rest of the world

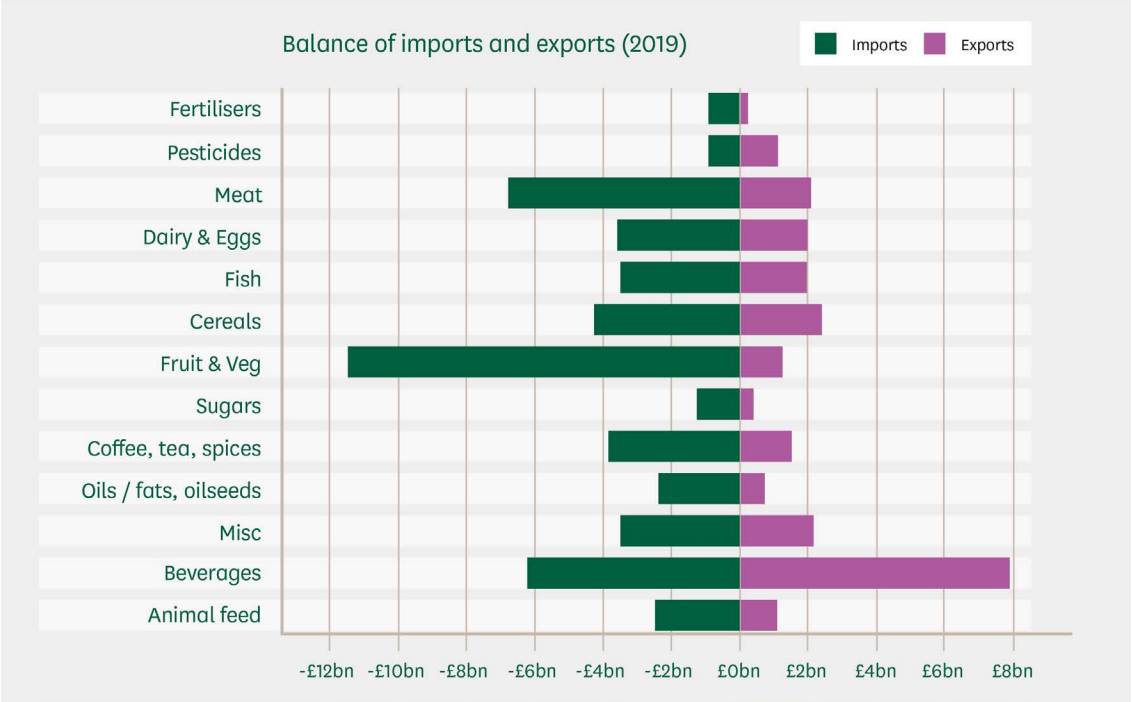


Source: Defra, Food statistics in your pocket, updated 3 November 2023, Table 3.1: Origins of food consumed in the UK, 2022

30. Despite the UK's strong position relative to other countries, it is still important to prioritise, sustain, and improve self-sufficiency.[79] That self-sufficiency is not even across all categories. The UK is much more dependent on imports for some foods that are critical to health; for example 84% of fruit is imported.[80] Self-sufficiency also fluctuates throughout the year due to seasonality. Dr Monika Zurek, Senior Researcher at the University of Oxford's Environmental Change Unit, explained that the shortages from Spain and Morocco experienced last winter came at a time of year when "almost 80% of fruit and vegetables" was imported, "mainly from these two areas".[81]

79 Landworkers' Alliance - Farmers Union (ECFS0017)
80 Defra, UK Food Security Report 2021, 16 December 2021, p 86
81 Q32

Figure 2: The UK's balance of imports and exports differs for different food products and inputs



Source: Chatham House, UK food nutrition security in a global COVID-19 context: an early stock take, November 2020

31. It is also the case that many of the countries from which the UK imports food are climate-stressed, potentially jeopardising supply in the future.[82] Furthermore, because UK food production tends to be relatively intensive in nature, any production offshored could triple or quadruple the biodiversity impact, as explained by Dr Elizabeth Boakes:

> Every hectare of arable land that we convert to housing or something and then offshore the food production must be replaced by on average 2.9 hectares of land overseas, which will often be in tropical countries that will, therefore, have a much higher biodiversity impact, sometimes three to four times higher than in the UK.[83]

The UK as part of the global food system

32. Richard Millar, Head of Adaptation at the Climate Change Committee, impressed upon us that improving the UK's food security is not only a question of improving its self-sufficiency. He argued that there "would be some risks in bringing too much production back to the UK", as this would result in more exposure to extreme weather events in the UK such as last year's heatwave.[84]

33. There are some examples of crops that actually produce more emissions in the UK than if they are imported. Guy Singh-Watson, founder of Riverford Organics, told us that a pepper grown in the UK using generated heat has 10 times the carbon footprint of a pepper imported from southern Europe but grown without heat.[85] However, he explained

82 Scheelbeek, P.F.D., Moss, C., Kastner, T. et al., "United Kingdom's fruit and vegetable supply is increasingly dependent on imports from climate-vulnerable producing countries", Nature Food 1, 705–712 (2020)
83 Q49
84 Q25
85 Q73

that while it is "not always true that local food is better… it usually is", and the reason is "mainly the transport", as well as lower emissions from processing and packaging.[86] Mr Singh-Watson added that there are occasions where "there is an environmental argument for growing a crop where it is comfortable", but on the whole it is best to grow it "as close to where it is going to be consumed as possible".[87] We will explore some of the technological opportunities for home-grown produce in chapter 5.

34. Witnesses emphasised that however much the UK wants to improve its self-sufficiency, it will always be inextricable from "international supply chains and the climate risks along them".[88] Our evidence pointed to various products and inputs imported from around the world in order to produce the food grown in the UK: these include fertiliser, pesticide, animal feed, and machinery.[89] In view of this interdependency, we were encouraged to consider the UK food system as part of the global food system.

International trading standards

35. Given that UK food security requires a degree of trade, there is a risk that efforts made at home to improve the environmental standards of domestic produce could then lead to environmental harms being offshored, as explained by Henry Dimbleby:

> There is absolutely no point in creating a farming system in this country that is carbon neutral, restores biodiversity, feeds us, and has higher levels of animal welfare, which our citizens care a lot about, and then allowing the import of foods that are cheaper because they do not do those things… [I]f they do not do those things and are cheaper, you are basically just exporting those environmental harms, those animal welfare cruelties, and that destruction of biodiversity abroad, and the whole thing becomes a sham. You also completely undermine our farmers.[90]

Witnesses underlined that it is therefore important to ensure that the UK's trade deals with its trading partners include high environmental standards for food production on an equal footing.[91] This is something for which both the food industry and environmental groups have advocated: representatives wrote to the International Trade Secretary last October calling for "world leading core standards" for food, environment, and animal welfare to apply to future trade deals.[92]

36. The Government's food strategy sets out its vision for the UK's role in the global food system, including a statement that it is "working to increase the sustainability of agriculture internationally to help build a resilient and secure global food system whilst supporting people, climate and nature". The strategy refers to the Conservative party's

86 Q94; cf. Landworkers' Alliance - Farmers Union (ECFS0017)
87 Q94
88 Q25 [Richard Millar]
89 Q25; Q52; Nature Friendly Farming Network (ECFS0024); Feedback (ECFS0035); Sustain: the alliance for better food and farming (ECFS0047); Good Food Institute Europe (ECFS0049); George Monbiot (Journalist and Author) (ECFS0070)
90 Q127; cf. e.g. National Farmers' Union (ECFS0020)
91 Q51 [Professor Tim Lang]; Q140 [Henry Dimbleby]; Game & Wildlife Conservation Trust (ECFS0055)
92 "Food and environmental groups call for minimum standards in trade deals", Chartered Institute of Environmental Health", 20 October 2022; cf. Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust ; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018); Nature Friendly Farming Network (ECFS0024); Institute for Public Policy Research (IPPR) (ECFS0031); Sustain: the alliance for better food and farming (ECFS0047); WWF-UK (ECFS0065)

manifesto pledge not to compromise on high environmental protection, animal welfare and food standards in trade negotiations, and states that future free trade agreements will consider factors such as climate change and the environment.

37. But the strategy does not include any specific trade standards for the environment and food production. This contrasts with the strategy's approach to animal health, where the Government intends to publish "a statement on our independent animal health and production regime"; this statement will require that "those wishing to access the UK market must objectively demonstrate their approach continues to deliver an equivalent level of health protection to our domestic standards".[93] We also note that the Government's third National Adaptation Programme, published in July 2023, states Defra's aim to incorporate climate scenario analysis into trade models by 2025.[94]

38. The strategy offers by way of illustration the Government's recently negotiated free trade agreements with Australia and New Zealand, which exclude pig meat, chicken, and eggs from the favourable tariff preference regime due to animal welfare concerns, and include a chapter dedicated to the environment. However, while that chapter articulates the countries' shared recognition of the importance of various environmental considerations, it again does not have common standards.[95] We received concerns in evidence about the potential environmental impacts of those trade deals: for example, Professor Tim Lang, Emeritus Professor of Food Policy at City University London's Centre for Food Policy, warned that "in 15 years, hormones and pesticides that are not currently usable will be usable. We will be importing them in the offshored way".[96]

39. When we asked the Minister about the extent to which food security was on the agenda of free trade deals, he informed us that Defra is involved in negotiations.[97] He also cautioned that due to differences in conditions, other countries have different standards for the way they produce food: not "worse or better" standards, but "different".[98] He was positive about the UK's potential to demonstrate global leadership in this arena:

> I think that geographically this is a great place to try to influence the world and supply other countries with top quality food. If we can do that in a way that is seen to be beneficial to the environment, we can demonstrate some global leadership here and demonstrate to the rest of the world that there are alternative ways of producing food and protecting the planet at the same time.[99]

Concentration of the food system

40. A hallmark of both the UK and global food systems that repeatedly came up in evidence is their concentration at all levels.[100] Here in the UK, "five supermarkets have about three quarters of the market; nine supermarkets have 95.2% of all the British food

93 Defra, Government food strategy, June 2022, p 30
94 HM Government, The Third National Adaptation Programme and the Fourth Strategy for Climate Adaptation Reporting, 18 July 2023, p 103
95 Department for Business and Trade and Department for International Trade, UK-Australia FTA Chapter 22: Environment, published 16 December 2021
96 Q51; cf. National Sheep Association (ECFS0011)
97 Q266
98 Q268
99 Q266
100 E.g. Transforming UK Food Systems Programme (ECFS0013); Landworkers' Alliance - Farmers Union (ECFS0017)

retail market".[101] Dr Elizabeth Boakes explained that "we are so dependent on … hand to mouth supplies that if there is an unpredictable climate event, that exacerbates the other supply issues that we have".[102] Professor Tim Lang, Emeritus Professor of Food Policy at City University London's Centre for Food Policy, explained that this concentration is driven by the fact that "the incentive in the market is to get food at the lowest cost".[103]

41. Concentration also characterises the global food system, as was illustrated to us by George Monbiot:

> It is a system that is losing its resilience in a very similar way to how the global financial system was losing its resilience in the approach to 2008, and for very similar reasons: extreme corporate concentration, similar strategies being pursued by the same corporations, synchronisation and the loss of what system theories call modularity—in other words, a compartmentalisation of the system; everything flows into one as trade goes around the world.[104]

An example of the concentration of the global food system is the world's reliance on just four plants: wheat, rice, maize and soybeans provide almost 60% of calories grown by farmers. In turn, these plants are mostly grown in only a few countries.[105]

42. This concentration, Mr Monbiot and others argued, weakens the resilience of the global food system because it makes it more vulnerable to sudden shocks.[106] He gave the example of bottlenecks in the flow of grain around the world:

> 55% of global grain trade goes through a number of pinch points: the Turkish straits, the Strait of Malacca, Bab-el-Mandeb, the Strait of Hormuz, the Suez Canal, the Panama Canal. We have been amazingly lucky so far. The Ever Given got stuck across the Suez Canal in 2021. The Russian invasion of Ukraine was in 2022. If those two things had coincided, the food chain could have snapped for hundreds of millions of people. The shelves could have cleared.[107]

Mr Monbiot described the global food system as "on a knife edge a lot of the time", warning that "the thing that tips the system over the brink is impossible to predict".[108]

43. The solution to improving the resilience of a concentrated food system, we heard across the board, is to diversify it.[109] We heard that there was a need to introduce more diversity at all levels of the food system, from the species grown and reared, to the suppliers contracted, to the farming techniques employed.[110] Baroness Brown argued that "we should be encouraging greater mixtures and use of rarer breeds of plants and animals, alongside those that are deemed to be the most productive", explaining that if you use just one breed your entire stock will be affected if a new disease tears through

101 Q38 [Professor Tim Lang]
102 Q36
103 Q38
104 Q187
105 George Monbiot (ECFS0070)
106 Cf. Global Sustainability Institute (ECFS0004)
107 Q192
108 Q189; Q192
109 Q39 [Professor Tim Lang]; Q192 [George Monbiot]; Landworkers' Alliance - Farmers Union (ECFS0017)
110 Q5 [Richard Millar]; Q16 [Baroness Brown]; Q188 [Professor James Lowenberg-DeBoer]

your farm.[111] Professor James Lowenberg-DeBoer, Elizabeth Creak Chair of Agri-Tech Economics, Harper Adams University, catalogued a variety of ways in which diversity can be introduced to create resilience:

> If you depend on one or two or three sources of food, those can be easily disrupted, and history gives us ample examples of what happens. If you depend too much on imports, disruption of imports by war or natural disaster causes a problem. If you depend only on corporate farms, there are other issues that happen. Therefore, having a diverse food system with different kinds of producers, different kinds of farms with different specialties, different sizes in different parts of the country and in different parts of the world, it creates resilience.[112]

Conclusions and recommendation on the food system

44. **Food self-sufficiency is an important aspect of food security. When developing relevant strategies, the Government must recognise the risks of national over-reliance on imports for many products, as experience earlier this year of empty shelves for certain salad items has taught.**

45. **The UK food system is inseparable from the global food system, and increasing food security is not only a question of improving domestic self-sufficiency. To rely only on domestic production would increase the UK's vulnerability to extreme weather events in the UK. Even food produced at home depends on importing certain components from abroad, such as animal feed, fertilisers, and pesticide.**

46. **Since food security depends on some degree of imports, it is vital that environmental harms are not exported abroad. That is why it is so important to get the UK's trade deals right on food and the environment. We welcome the Minister's desire to demonstrate global leadership on food production and the environment. *The Government must show its leadership by upholding standards for the environmental impacts of food production in its trading relationships with other countries. It should publish a statement on climate and biodiversity standards for food production, equivalent to its promised statement on animal health. Its commitment to incorporate climate scenario analysis into trade models by 2025 should be matched by biodiversity scenario analysis.***

47. **The food system globally and in the UK has become too concentrated and too driven by price alone. The Government and food industries must focus on embedding more diversity of produce and farming methods within the food system and reducing concentration in the market.**

111 Q16
112 Q188

Our analysis of the Government's policy framework

Government food strategy

48. The Government published its food strategy in June 2022, in response to the independent review of the UK food system published by Henry Dimbleby in 2020 and 2021.[113] We scrutinise the detail of the food strategy throughout this report; here we offer an overview and our contributors' overall reaction to the strategy.

49. Commitments in the strategy that relate to environmental change include:

- An ambition to "maintain the current level of food we produce domestically, including sustainably boosting production in sectors where there are post-Brexit opportunities including horticulture and seafood";
- A commitment to report progress against the food strategy goals alongside the next UK Food Security report;
- Funding to support innovation and work to review skills programmes for the agri-food workforce;
- The promise of a Land Use Framework;
- Work to promote healthier and more sustainable diets;
- A Food Data Transparency Partnership, and
- A consultation on public procurement.

50. Several contributors to our inquiry were disappointed that, in their view, the food strategy insufficiently addresses issues of climate change adaptation, food production, and implementation. Perhaps the highest profile was the Government's own adviser, Henry Dimbleby, who is widely reported to have described the strategy as "not a strategy". He and others have expressed disappointment that many of his recommendations were not taken forward.[114] He told us that "on the environmental transition… the framework of that is in place", but that "there is a potential disaster on trade".[115] He also said that "given the current volatility", which we set out above, the Government's food security report, currently promised at least every three years, "should be done annually"—a view shared by others, including the EFRA Committee.[116] The Government rejected the EFRA Committee's recommendation on the basis that many of the measures within the UK Food Security Report are already published annually.[117]

113 Defra, Government food strategy, June 2022; Defra, National food strategy for England, published 29 July 2020

114 "UK food review head calls for 'much bolder' action on climate change and obesity", Financial Times, 12 June 2022; "Food plan for England condemned by its own lead adviser", The Guardian, 13 June 2022; "Government's vision for food industry is 'not a strategy', Leon founder Henry Dimbleby says", Sky News, 13 June 2022; Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018); Soil Association (ECFS0041); Sustain: the alliance for better food and farming (ECFS0047); Norwich Research Park (ECFS0053)

115 Q121

116 Q142; Community Planning Alliance (ECFS0006); National Farmers' Union (ECFS0020); EFRA Committee, Seventh Report of Session 2022–2023, Food Security, HC 622, para 13

117 EFRA Committee, First Special Report of Session 2023–24, Food Security: Government Response to the Committee's Seventh Report of 2022–23, HC 37

51. Other witnesses were more lukewarm than Mr Dimbleby about the environmental aspects of the food strategy.[118] Baroness Brown said that "the food strategy does not have anything specific on actions to adapt to the threats of climate change" and that the Government lacks "a clear strategy for agriculture and developing resilience to the impacts of climate change in agriculture".[119] Indeed, there are only two references to climate change adaptation in the strategy: the first is in looking ahead to publication of the Government's Land Use Framework, which the strategy says will "help our farmers adapt to a changing climate"; and the second is a passing reference to "the important role" of the 'Grimsby cluster'—an alliance of 70 seafood companies—"in ensuring the sector can… adapt to climate change".

52. Professor Tim Lang described the Government's strategy as "basically saying nothing" about questions such as "How much food? Does it matter where it comes from? Does it matter how it is produced? Does it matter what the British eat?".[120] James Young gave McCain's view that the strategy does not explain what farmers need to do: "the focus on being clear on how the food is produced, the way it is produced and improving that resilience is missing from there".[121] Minette Batters added that the strategy needed to be developed into a "meaningful policy document" that will "incorporate the ambition of net zero and joining up food production with environmental delivery".[122] Our sister committee, the EFRA Committee, also concluded that the food strategy "has fallen short".[123]

53. When we put to the Minister the concerns we heard that the food strategy does not go far enough on the environment, he rejected that assessment, saying: "I don't think that food security has ever been as high on the political agenda as it is now. To suggest that the Government are not thinking about this is completely wrong".[124]

Long-term planning

54. There was support in evidence for some form of committee or forum to bring together all participants in the food system. Dr Monika Zurek said that the UK lacks a "platform" for "different actors", such as Government, supermarkets, and community organisations, to collaborate on delivering a well-functioning food system.[125] Balwinder Dhoot, Director of Sustainability, Food and Drink Federation, praised the work of the food resilience industry forum that the Government established during the covid-19 pandemic. However, he argued that since that forum works on "immediate issues", a "different forum" is required to provide "certainty about the long-term" issues of climate change and sustainability.[126] He called for a cabinet committee to co-ordinate food security work across Government departments, while others called for a new statutory body or a UK food security council to anticipate disruptions and target support where it is needed, as well as for better modelling of different scenarios.[127] The James Hutton

118 See e.g. Norwich Research Park (ECFS0053); Grantham Research Institute on Climate Change and the Environment (ECFS0054)
119 Qq14–15
120 Q45; cf. Dairy UK (ECFS0014)
121 Q82; McCain Foods (GB) Ltd (ECFS0039)
122 Q155
123 EFRA Committee, Seventh Report of Session 2022–2023, Food Security, HC 622, para 18
124 Q265
125 Q37
126 Qq74–75
127 Q79; Institute for Public Policy Research (IPPR) (ECFS0031); McCain Foods (GB) Ltd (ECFS0039); Global Sustainability Institute (ECFS0004)

Institute, a research organisation specialising in the sustainable use of land and natural resources, also highlighted the need, currently absent from the Government's food strategy, to develop contingency plans in the event of "multiple or cascading impacts".[128]

55. The EFRA Committee also found that the Government's approach to food policy was "incoherent", and that "the successes of food policy coordination across Whitehall forged during the covid-19 pandemic have not been maintained". It recommended that "the Cabinet Office should undertake a comprehensive review of departmental responsibilities and structures regarding food policy".[129]

56. When we asked the Minister whether a cross-government food security forum exists, he stated that Defra was the lead Government Department:

> I do see DEFRA as being the lead Department in this fight and in this challenge. I would encourage you to aim your report at us and let us absorb it and challenge us with the responsibility to go and push those other Government Departments in the direction that you want to see us go in.[130]

Public procurement

57. Alongside its food strategy, the Government launched a consultation on public sector food and catering policy, including proposed reforms to the Government Buying Standards for Food and Catering Services.[131] The Government intends to issue its response to the consultation later this year. From an environmental perspective, the consultation includes proposals for higher environmental production standards, menu cycle and seasonality, energy management, and waste prevention.[132] The Government's food strategy states that within this consultation, "we will propose that the public sector reports on progress towards an aspiration that 50% of its food expenditure is on food produced locally or to higher environmental production standards such as organic, Linking Environment and Farming (LEAF) Marque or equivalent".[133]

58. In his review, Henry Dimbleby recommended that the Government redesign the Government Buying Standards for Food and Catering Services, and that the standards should be mandatory for all public sector organisations. He also recommended a mandatory accreditation scheme for all public institutions, roll-out of a procurement scheme that enables local food suppliers to sell their produce via an online procurement page, and for the Food Standards Agency to assess annually how procurement budgets are being spent and meeting the new standards.[134] In evidence to us, Henry Dimbleby reiterated his view that public procurement standards for biodiversity, carbon, and health, should be "mandatory", and that public procurement needs "the ability to enable big institutions to buy locally rather than just using the big wholesalers".[135] Judicaelle Hammond supported this position, saying that it was "disappointing" that the "ambition" in the food strategy on

128 James Hutton Institute (ECFS0033)
129 EFRA Committee, Seventh Report of Session 2022–23, Food Security, HC 622, para 23
130 Q316
131 Defra, Public sector food and catering policy, published 13 June 2022
132 Defra, Public sector food and catering policy for England: The Government Buying Standards for Food and Catering Services (GBSF) - Proposed document for June 2022 consultation
133 The consultation defines "locally produced food" as: "Ingredients produced/grown/caught within the same region as it is consumed, or a neighbouring county".
134 Defra, National Food Strategy: part two, 15 July 2021, p 161
135 Q122; Q137

public procurement was not a "target", and that the Government should "make it a target and put your money where your mouth is".[136] Others also called for clearer commitments on local public procurement.[137]

Waste prevention and reduction

59. We received several calls for the Government to do more to reduce waste in the food system.[138] As a means of maintaining food security and minimising environmental impacts, University of Essex experts described waste reduction as "low-hanging fruit", saying that it is often cheaper, quicker, and easier to reduce waste than it is to grow more food.[139] In its food strategy, the Government commits to:

- Consulting on improved food waste reporting for large food businesses;
- Helping households to waste less food with the Waste and Resources Action programme;
- Requiring English local authorities to collect food waste separately, and
- Reducing packaging-waste through the Extended Producer Responsibility and Deposit Return Scheme.

60. However, our evidence called on the Government to go further. Some called for a food waste reduction strategy or policy,[140] and others called for targets for reducing not just food waste but fertiliser waste too.[141] There was also support for extending mandatory food waste reporting to all food businesses, which we will explore further in the next chapter.

The role of the seafood sector in food security

61. The Food Ethics Council included in its written evidence a challenge that "water-based food supplies are too often neglected in discussions about food security in the land".[142] That has been the case in our inquiry too, with little of our evidence addressing seafood and aquaculture. We received evidence that the UK is less than 20% self-sufficient in seafood, and that fish is among the UK's top three food and drink imports (alongside wine and fruit).[143] We explored in the Introduction to this report the implications of environmental change for that sector.

136 Q255; cf. Soil Association (ECFS0041)
137 E.g. Landworkers' Alliance - Farmers Union (ECFS0017); Sustain: the alliance for better food and farming (ECFS0047); WWF-UK (ECFS0065)
138 E.g. The Country Land and Business Association (ECFS0042); Sustain: the alliance for better food and farming (ECFS0047); CPRE the countryside charity (ECFS0063)
139 University of Essex (ECFS0009)
140 University of Essex (ECFS0009); Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)
141 Green Alliance (ECFS0056); WWF-UK (ECFS0065)
142 Food Ethics Council (ECFS0062)
143 Defra (ECFS0022); WWF-UK (ECFS0065)

62. We heard, then, that securing a sustainable seafood supply should be part of the Government's strategy for maintaining food security in a context of environmental change. The Government's food strategy and written evidence to our inquiry set out some high-level intentions for the UK seafood industry:

- Growing the domestic consumption and production of seafood;[144]
- Working with stakeholders to identify suitable interventions around supply and consumer behaviour;[145]
- Investing £100 million in the UK seafood fund, including funding innovation and technology in seafood. This £100 million includes £24 million for seafood science and £65 million for infrastructure and facilities, and
- Working with the Grimsby Cluster—which represents the Humber's seafood and trade processing cluster—on taking advantage of new trade deals, adapting to climate change, and increasing uptake of skills training.[146]

63. The National Federation of Fishermen's Organisations criticised the Government's food strategy for lacking concrete action on the role of aquaculture in UK food security, saying: "[t]he Food Strategy is effectively completely silent on this topic apart from some pieties about putting fish on the menu".[147] It called for continuous, rather than time-limited, funding for seafood innovation research.

64. The Wildlife & Countryside Link, alongside several other nature charities, were optimistic about the contribution that Highly Protected Marine Areas (HPMAs) could make.[148] HMPAs are areas of the sea that are given high levels of protection to allow marine ecosystems to recover to a more natural state.[149] The Government is currently conducting HPMAs pilots on three sites.[150] According to the Wildlife & Countryside Link and others, by conserving wildlife and habitats, HPMAs could contribute to food security because "the number, diversity and size of fish will increase".[151] The Blue Marine Foundation called on the Government to introduce at least five HPMAs.[152] The National Federation of Fishermen's Organisations, however, was concerned that expanding HPMAs could "mean that the space available to fishing is being severely reduced";[153] the Wildlife & Countryside Link and others countered that HPMAs "should not be seen as standing in opposition to a flourishing fisheries sector which bolsters domestic supply" on the basis that they can restore marine life.[154] They gave the example that some species in Scotland's first no-take zone were boosted by 400% since protection measures were first introduced.[155]

144 Defra (ECFS0022); Defra, Government Food Strategy, June 2022, p 15
145 Defra (ECFS0022)
146 Defra, Government Food Strategy, June 2022, pp 17–18
147 The National Federation of Fishermen's Organisations (ECFS0043)
148 Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)
149 Defra, Highly Protected Marine Areas (HMPAs), updated 25 May 2023
150 Defra, Highly Protected Marine Areas (HMPAs), updated 25 May 2023
151 Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)
152 Blue Marine Foundation (ECFS0007)
153 The National Federation of Fishermen's Organisations (ECFS0043)
154 Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)
155 The 'no-take zone' is equivalent to an HPMA: see further Scottish Environment LINK, Highly Protected Marine Areas - FAQs, 7 April 2023

65. To limit overfishing further and thereby produce a high sustainable level of fish in UK waters, the Blue Marine Foundation called on the Government to set catch limits below the maximum sustainable yield, and ban bottom-trawling in all offshore marine protected areas.[156]

Conclusions and recommendations on the Government's policy framework

66. ***Given the increasing volatility in food supplies, not just due to extreme weather, but also due to the recent geopolitical and health crises we have experienced, the Government should publish its food security report annually rather than every three years as it has currently committed to. The fact that many of the measures included in the food security report are already published annually only lends more support, in our view, to the argument that the food security report ought to be published every year.***

67. **Defra collaborates with other Government departments and with industry on food security issues, but this work is neither sufficiently co-ordinated nor long-term.** ***The Government should establish a cross-government, cross-sector food security body to bring together all the actors in the food system to examine and make policy recommendations on long-term food resilience and environmental issues. While much food policy is devolved, some areas that affect food security, such as trade, are not devolved; and many farms straddle territorial borders. Therefore the cross-government body should also involve the devolved administrations. The body could be in the form of a Food Resilience Forum, but must take a long-term view. One responsibility with which this platform could be tasked would be to conduct forward-looking reviews in specific markets to inform investigations ahead of, rather than during, a crisis.***

68. **The fact that the Government currently only has an "aspiration" for half of public money spent on food to be produced within the local area or produced to higher environmental standards is a missed opportunity.** ***The Government should turn its ambition on public procurement into setting a target, and should set mandatory environmental standards for publicly procured food.***

69. **Preventing and reducing waste at all stages in the food chain should be a central component of the Government's food strategy, as this is a quick-win compared to other actions to maintain food security in the face of environmental change.** ***The Government should publish a strategy for preventing and reducing waste in the food system. This should include targets and timescales, not just for reducing wastage of food itself but also for reducing the waste of resources that go into producing food, such as fertiliser and water.***

70. **We welcome the Government's ambitions to boost the UK seafood industry, a sector which is currently heavily reliant on imports. But significantly more detail is required on how it will do so in an environmentally sustainable way.** ***The Government must publish concrete proposals for improving the contribution of UK seafood to food security, setting out clearly how its proposals will improve rather than harm the natural environment.***

156 Blue Marine Foundation (ECFS0007)

2 Data and metrics

Agreeing a baseline

71. A common theme in our evidence was the absence of agreed measurements for the environmental impacts of food. Contributors argued that baseline metrics should be set for soil health, carbon sequestration, and nature reduction.[157] Minette Batters added that the tools for measuring the baseline should also be agreed upon, arguing that without "consistency right across the country", there will not be accurate data to know that the food sector is making progress on environmental goals.[158]

72. In addition to measuring progress, we heard that having agreed metrics and tools is also important for building trust among farmers and growers. Peter Dawson, Policy and Sustainability Director at Dairy UK, told us that not having consistent metrics and tools creates "challenges [for] winning farmer engagement", since farmers have "concerns that the IT tools that they are using to do this come up with different results".[159]

73. Stakeholders felt that the responsibility for setting baseline metrics should lie with the Government.[160] Henry Dimbleby stressed that it is baseline metrics, and not the "gold standard", that the Government should set, because the Government's requirement to carry out consultations carries "a risk that the gold standard is five years behind what the actual gold standard is". Instead, he recommended that bodies such as the Soil Association or Red Tractor should compete to set the gold standard.[161]

74. The Government Food Strategy launched the "Food Data Transparency Partnership", which brings together government departments and agencies in England and the devolved administrations as well as representatives from the food sector and civil society. Among its tasks is to "look at the development of consistent and defined metrics to objectively measure the health, environmental sustainability, and animal welfare impacts of food". We learned more about this work at our evidence session with the Minister and the Defra official, Tessa Jones, Agri-Food Chain Director. The Minister stated that "establishing the baselines is the first thing that we need to do" and that "there is a lot of thought in the Department going into establishing those".[162] He too saw the benefits of being able to both "measure" and "benchmark" the "environmental standards" of farming.[163] Both he and Ms Jones outlined that Defra officials were collaborating with industry representatives to establish baseline metrics for carbon sequestration in soil, methane output of ruminants, and scope 3 greenhouse gas emissions.[164] They were unable to provide a date by when

157 Q128 [Henry Dimbleby]; Q158 [Minette Batters]
158 Q158
159 Q159
160 Q130 [Henry Dimbleby]; Q158 [Minette Batters]
161 Q130
162 Q303
163 Q304
164 Qq303–305. Scope 3 greenhouse gas emissions are the indirect emissions that occur in the upstream and downstream activities of an organisation, as opposed to direct emissions (scope 1) and indirect emissions arising from the purchase and use of electricity, steam, heating, and cooling (scope 2). Carbon Trust, What are Scope 3 emissions?

these baselines would be finalised, but Tessa Jones said that "work will take place over the next 12 months or so to start to look at what that methodology [for measuring the baseline] might look like".[165]

Reporting food data and metrics

75. When it comes to reporting the environmental impacts of food production, we received mixed evidence on the benefits of food labelling. The Government places much weight on consumers being able to make informed choices: a position that in and of itself seems perfectly sensible. However, as a tool for shifting consumer behaviour, our evidence indicated that furnishing consumers with information is not a silver bullet that causes a paradigm shift towards more environmentally friendly individual choices.

76. Henry Dimbleby shared that from the "focus groups and quantitative research" he did for his independent review, consumers said:

> I want the animal to be treated well, but that is not my job; that is the Government's job. I just want to know that there's a basic level of sustainability and animal welfare in the product I buy. I don't have time to look at all the labels in the aisle.[166]

This echoed the experience shared by Guy Singh-Watson of Riverford Organics, who has been carbon foot-printing his vegetable boxes since 2007:

> [W]e thought we would carbon label the boxes and people would select the lowest carbon box and that would drive us to have better practices and whatever. Very quickly it became apparent that that approach was completely hopeless. Indeed, I would extrapolate from that to say that any idea that a well-informed consumer is going to drive improvements in these incredibly complex areas is just ridiculous. It is just a smokescreen used to resist legislation.[167]

77. After we concluded evidence taking for this inquiry, a Durham University study found that cigarette-style graphic labels on meat products warning of climate risks did effectively discourage participants from choosing meals containing meat.[168]

78. However, the mixed evidence on the efficacy of food labelling as a vehicle for changing individual consumer behaviour does not mean that there is no value in reporting food sustainability metrics. Both Mr Singh-Watson and Mr Dimbleby shared their view that food labelling can drive positive change at a business level. Mr Dimbleby said: "What being forced to put something on a package does do—I know this from experience at Leon, the restaurant chain that I set up and used to own a bit of—is really focus the people in the business".[169] The example Mr Singh-Watson gave was that labelling identified "where the real carbon costs of the business were", which led him to terminate contracts with companies that use heated glass.[170]

165 Qq305–306
166 Q131
167 Q93
168 "Graphic warning labels could reduce people's meat consumption", Durham University, 1 November 2023
169 Q131
170 Q93

79. We heard that monitoring and reporting waste at the corporate level has the same effect. University of Essex researchers on food waste in food supply chains told us:

> The findings from our project indicate that, while a good proportion of food is wasted in food supply chains, food firms tend to internalise these losses and hence are not very much conscious about this food loss in their supply chains …
>
> If the government encourages food firms to measure food waste, record, [and] compare these levels over time [it] will help firms to think about food waste more clearly …
>
> When the true costs of food waste is captured in the decision-making processes of food companies, they will be able to take every effort to protect food and reduce waste.[171]

80. They, along with others, suggested that the Government should require all food businesses to report on waste in their operations, and not just large businesses. The Government recently consulted on food waste reporting by businesses. In July 2023 it came to the conclusion that it would be too costly to impose a mandatory requirement on businesses to report food waste, a cost that could be passed onto consumers. However, in November 2023 it withdrew that response and the recently appointed Secretary of State for Environment, Food and Rural Affairs is reconsidering whether mandatory food waste reporting should be introduced in the future.[172] We heard from experts that there is already considerable interest within the food industry for measuring the environmental impact of produce. Some companies have "an appetite … to calculate their biodiversity footprints", according to Dr Elizabeth Boakes, but they struggle "because they do not have transparent supply chains".[173] The Committee heard from Peter Dawson that the dairy industry already has a target "for all dairy farmers in the United Kingdom to undertake carbon foot-printing, ideally by the middle of this year". However, Mr Dawson added that the industry was unlikely to meet that target: currently 40% of dairy farmers are "regularly carbon foot-printing".[174]

81. One nuance of food labelling that witnesses stressed was the distinction between calculating food sustainability metrics by weight, as opposed to the nutritional content of food.[175] For example, Chris Brown, the Senior Director for Sustainable Supply Chains, Asda, pointed out that "a kilo of cabbage is 90% water, but a kilo of beef is only 30% water".[176]

82. One of the goals of the Government's Food Data Transparency Partnership is to explore mandatory food sustainability reporting:

> We will consult on implementing mandatory public reporting against a set of health metrics and explore a similar approach to sustainability and

171 University of Essex (ECFS0009)
172 Defra, Summary of responses and government response: Improved food waste reporting by large food businesses in England, July 2023 [withdrawn]; Defra, Consultation outcome: Improved food waste reporting by large food businesses in England, updated 21 November 2023
173 Q60
174 Q159
175 E.g. National Farmers' Union (ECFS0020)
176 Q161

> animal welfare. We will also provide consumers with the information they need to make more sustainable, ethical, and healthier food choices and incentivise industry to produce healthier and more ethical and sustainable food.[177]

On sustainability reporting, the Government Food Strategy commits the Government to developing a mandatory methodology for companies that wish to report:

> [W]e will develop a mandatory methodology that must be used by those who want to produce eco labels or make claims about the sustainability of their products. This will drive integrity in the food system by preventing 'green washing' claims whilst we work with industry to improve environmental information for consumers.

In evidence, organisations such as WWF called for mandatory food labelling that addresses both nature and climate.[178]

83. When we questioned the Minister on the Government's plans for mandatory food sustainability reporting, he warned that "we have to be careful that we do not over-label our foods", because if labels provided all the information that different consumers value—such as carbon footprint, calories, welfare standards, and so on—"you would get a sheet of A4 paper with every food item that you buy".[179] He added that "there is a lot of positive work that is taking place" between the Government and the industry, and contended that "in effect" the Government has "set a requirement" for industry, "because we have committed to net zero".[180]

Conclusions and recommendations on data and metrics

84. **We welcome the Food Data Transparency Partnership and the progress it is making towards establishing baseline food sustainability metrics and methodologies. However, more clarity is needed on the areas in which the Government intends to set metrics and its timescales for doing so. Such metrics and tools are vital for knowing where action should be focused, and whether progress is being made to improve food resilience, soil health, carbon sequestration and nature restoration. A common standard for these measurements is also essential to maintain trust between policy-makers and the agriculture sector.**

85. ***The Government should list all the areas in which it intends to establish baseline metrics and tools for food sustainability. These should include but may not be limited to: soil health, carbon sequestration, biodiversity net gain, and carbon credits. It should publish a timetable for when each metric will be in place.***

86. ***Only once national baseline metrics are in place, the Government should consult on mandatory carbon and biodiversity food reporting, as it is already doing for health metrics. The methodology for such reporting must account for the nutritional content of food.***

177 Defra, Government Food Strategy, June 2022, p 11
178 WWF-UK (ECFS0065)
179 Q311
180 Q312

87. ***The Government should also consider compulsory reporting of waste by all food businesses as part of the waste prevention and reduction strategy that we recommend.***

3 Soil and water

Soil

88. Throughout our inquiry we learnt about the primacy of good quality soils as a core foundation for food security. We also learnt how soil quality is at risk from climate change and biodiversity loss, and how the way soil is treated can itself contribute to climate change and biodiversity loss.[181] This interrelated set of circumstances was well illustrated by Baroness Brown.[182] She described how changing weather—such as increased prevalence of droughts, flooding, and more intense tropical rainfall—can degrade soils, meaning that steps must be taken to make them more "resilient" and "resistant". She added that those steps must not "rely on adding vastly more fertiliser, because we know that will contribute to increasing CO_2 emissions". Finally, she explained that in order for the UK Government to reach its net zero target—which, as we outlined in our introduction, is one of the key pillars of achieving food security—"we need the productivity of our land to be absolutely at its optimum", which requires "soils in good quality and good condition".

89. As mentioned in chapter 2, soil is an area which contributors felt was in need of better data and metrics. Baroness Brown said that "we do not know the condition of our soils and, unfortunately, we do not know how fast they are degrading".[183] This was supported by George Monbiot, who said:

> At the moment, our means of discerning soil carbon are extremely crude—too crude to give us reliable readings for changes from year to year. We need a great investment in soil science right across the board. Soil is more or less a black box to us, yet we produce 99% of our calories from it.[184]

90. Measuring soil quality is a complex task. As evidence submitted to the EFRA Committee's inquiry on Soil Health shows, there are hundreds of types of soils, the health of which is affected by biological, physical, and chemical factors, as well as by contaminants including metals, microplastics, and pharmaceuticals. For all these factors, accurate measurements depend on a range of conditions including land use, soil type, timing, frequency, depth, and spatial scale. Contributors to our sister committee's inquiry called for standardised methods for measuring soil health, with clear guidance for farmers, and warned that it may not be possible to capture soil health in a single indicator.[185]

91. Back in September 2021, the Government announced that it would publish a Soil Health Action Plan for England.[186] In oral evidence to us in January, Baroness Brown criticised the Government's lack of a soil strategy.[187] In September 2022, the Government confirmed during a House of Lords debate that its promised Soil Health Action Plan

181 E.g. Mr James Heyburn (Policy and Engagement Officer at Imperial Policy Forum); Dr Ana Mijic (Director, Centre for Systems Engineering and Innovation at Imperial College London); Dr Athanasios Paschalis (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering at Imperial College London); Ms Elizabeth Fonseca (Research Postgraduate, Centre for Environmental Policy at Imperial College London) (ECFS0012)

182 Q2

183 Q3

184 Q221

185 Written evidence submitted to the inquiry of EFRA Committee into *Soil Health*, Session 2022–23: University of Leeds (SH0087); Canterbury Christ Church University (SH0097); Soil Association (SH0103)

186 "Soil Health Action Plan to be launched", Defra, 9 September 2021

187 Q3

would be rolled into the Environmental Improvement Plan, which was published in January 2023.[188] In its progress report in March 2023, the Climate Change Committee called on the Government to include a stretching and comprehensive soil health target as a priority.[189]

92. Through its 25-year Environmental Improvement Plan, published in January, the Government has committed to:

- Publish a baseline map of soil health for England by 2028;
- Bring at least 40% of England's agricultural soil into sustainable management by 2028, rising to 60% by 2030;
- Establish a soil health indicator under the 25 Year Environment Plan Outcome Indicator Framework, and
- Provide a methodology and tools to collect consistent information about the health of the soil under all land uses.[190]

93. When we asked the Minister about the Government's plans to improve soil quality, he pointed us to the Sustainable Farming Incentive—one of the Environmental Land Management schemes—which "incentivise[s] good practice among farmers to look after their soil", and which we will examine further in chapter four.[191] He also referred to the ongoing work on developing a measurement for carbon sequestration: he said it was important to "get this right" to avoid "mis-comparing to other countries" and creating "a perverse incentive so that you are rewarded for damaging the environment.[192]

Conclusions and recommendations on soil

94. **We welcome the targets that the Government has set to establish a soil health indicator; provide a methodology and tools for measuring soil health; publish a baseline map of soil health by 2028; and bring 60% of soils in England into sustainable management by 2030.** ***We recognise that measuring soil health is highly complex, and recommend that the Government explore a suite of indicators taking into account different biological, physical, and chemical factors among others. The Government must provide clear guidance for farmers with a realistic set of science-based benchmarks that they can use to measure the health of their soils accurately and affordably.***

Water

Water security

95. A core component of soil health is good quality, reliable sources of water. However, as the weather becomes more extreme, with more periods of high temperatures and drought, water security is becoming an increasing issue for farmers. Much of 2022 was very dry

188 HL Deb, 8 September 2022, col 363 [Lords Chamber]
189 Climate Change Committee, Progress in adapting to climate change: 2023 Report to Parliament, March 2023, p 93
190 HM Government, Environmental Improvement Plan 2023, January 2023, p 165, 180
191 Q276
192 Q280

for large parts of the country: England experienced its sixth driest summer on record.[193] River flows were very low across the country and particularly in southern and eastern England.[194] The Scottish Environment Protection Agency suspended water abstraction licences for the first time in 2022 due to water scarcity.[195]

96. Drought affects farmers' ability to grow food and can have significant financial impacts on the agriculture sector, which in turn affects how much farmers are able to grow the following season.[196] Worryingly, the Country Land and Business Association highlighted how this poses further insecurity in sectors where the UK is not particularly self-sufficient such as fruit and vegetables, saying that "horticulturalists in the East of England are shifting to cereal production due to the lower risks posed by less water-demanding crops".[197]

97. Guy Singh-Watson gave us a personal account of how last year's drought had a "catastrophic" effect on his farm in Devon:

> With regard to the drought, after having a conversation with someone from the Met Office 10 years ago, we have invested heavily in winter storage, both on our farm in Cambridgeshire and my farm in France. Sadly, we did not in Devon and we did run out of water by about mid-August last year and basically every green crop after that failed. It cost us hundreds of thousands of pounds. It was catastrophic and we will certainly be investing in more winter storage.[198]

98. We heard of three solutions to adapt water supply to a changing environment: reduce demand; increase efficiency; and improve options for storing water when rain is plentiful. With regards to reducing demand, Baroness Brown said that the Climate Change Committee agrees with the National Infrastructure Commission that "the targets for reducing demand should be much more stringent", saying that demand currently sits at 140 litres per person per day and should instead be a maximum of 100 litres.[199] Others suggested accelerating the rollout of smart water meters, and applying public temporary use bans during periods of drought.[200]

99. To improve efficiency, we heard that there was scope to do more to transport water from wetter parts of the country to drier parts—broadly speaking, from west to east—and to fix leaks in existing reservoirs.[201] The praises of precision irrigation technology were also sung.[202] Professor James Lowenberg-DeBoer described how some manufacturers in the United States have systems that "can put a drop of water exactly where you want

193 "Joint hottest summer on record for England", Met Office, 1 September 2022
194 Wildlife and Countryside Link, 2022 Water levels and river flow rates (England) in the context of the last 21 years, August 2022
195 National Farmers Union Scotland (ECFS0010)
196 CCC, Progress in adapting to climate change – 2023 report to Parliament, 29 March 2023
197 The Country Land and Business Association (ECFS0042)
198 Q70
199 Q6
200 Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018); The Country Land and Business Association (ECFS0042)
201 Q6 [Baroness Brown]; Q26 [Richard Millar]; Q158 [Minette Batters]; Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)
202 Q6 [Baroness Brown]; Q205 [Professor James Lowenberg-DeBoer]; National Farmers Union Scotland (ECFS0010)

it".[203] The challenge is developing "the algorithms that will optimise that system", that is, by calculating where you want that drop of water.[204] He added that, to the best of his knowledge, such systems "are not being widely used" in the UK.[205] The opportunities afforded by precision irrigation came accompanied by a warning, from George Monbiot, to heed the "irrigation efficiency paradox":

> The more efficient you become, the more you end up using. That is because, like with your berry crops in East Anglia, you say, "Great, now water has become cheaper, it has become a smaller component of our overall costs, so we can grow more crops that require irrigation". You expand your irrigated area. We have seen a classic example of this in the Guadiaro Basin in Spain, where they invested €600 million in reducing water use and ended up creating more water use. It was a total catastrophe, and it is because they did not put controls on how the surplus water would be used. If you are to improve your irrigation efficiency, you also need to bring in regulations that say that this must not lead to an increase in water use, otherwise you create more of a problem than you started with.[206]

Water storage

100. There was significant appetite in evidence for the Government to do more to facilitate on-farm water storage, so that water can be extracted from rivers and stored when it is plentiful, to be used when rain is scarce. In November 2021, Defra launched a £10 million Water Management Grant scheme in England, which provides grant funding support—on a competitive basis—for the construction of on-farm reservoirs and the adoption of best practice irrigation application equipment. A second round of that grant with a further £10 million of funding closed in July this year. The Government's Plan for Water, published in April 2023, summarises ongoing and future policies to support a "secure supply of water for farmers". These include:

- A goal to increase water stored by agriculture and horticulture sectors by two-thirds by 2050;
- Allowing farmers to access water when needed in drought and enabling them to refill their reservoirs at more times in the year;
- Making it easier to obtain abstraction licences;
- Reviewing the allocation of abstraction rights;
- Supporting farmers with applications for the Water Management Grant, including with advice on abstraction licences and the planning process;
- Supporting development of Agricultural Water Resources Management Plans;
- Using existing models of collaboration where there are challenges with abstraction, and

203 Q205
204 Q205
205 Q205
206 Q206

- Launching a call for evidence on the planning barriers to building small reservoirs.[207]

101. Despite these commitments in the Plan for Water, stakeholders felt that not enough was being done to support on-farm reservoirs. The barriers were threefold: funding, planning, and abstraction. The first tranche of the £10 million Water Management Grant supported around 100 farmers.[208] If we assume that the second £10 million tranche will support a similar number of farmers, this means that roughly only 200 farmers in England will be supported by the Government's Water Management Grant. Even with a grant, Judicaelle Hammond informed us, farmers "need to find 60% of the funding from the bank".[209]

102. We also heard of difficulties with obtaining planning permission, and in particular with delays and bottlenecks.[210] And we heard of tensions with obtaining abstraction licences to extract water from rivers. Witnesses representing the farming industry felt that it was becoming difficult to acquire a licence, while others such as Baroness Brown felt that there was a need to place more "constraints" on abstraction, "because that is taking water away from nature".[211] Finally, these three issues are not only barriers in their own right, but they also prevent on-farm reservoirs from being built when they do not come together "in a timely manner": for example, if grant money is awarded, unless you already have planning permission, you are unlikely to have "the time to find a contractor to put a reservoir together and spend the money".[212]

103. When we put the challenges of water security and on-farm storage to the Minister, he replied that "there is lots we can do and lots we are doing".[213] He referred to the grants for water storage and drip irrigation techniques, and underlined the importance of "co-operation" as well as grants, pointing out that "not every farm needs to have its own reservoir" and that several farms could club together to build a shared reservoir.[214] On planning, the Minister shared that Defra is "having conversations with DLUHC [Department for Levelling Up, Housing and Communities]" to "unblock" the planning bottlenecks. He added that a model of permitted development rights—where planning permission is not required for changes of use class—could be an option for smaller scale projects.[215]

104. With regards to abstraction, Tessa Jones pointed to the Environment Agency's "abstraction plan", which is "bringing together the group of actors to look at the ways of water for crops and managing the environment".[216] The Minister underlined some of the difficulties associated with the historical nature of many abstraction permits. He gave a hypothetical example "where there may be a potato crop that is dying of thirst, that cannot

207 Defra, Our integrated plan for delivering clean and plentiful water, 4 April 2023, pp 65–66
208 Defra, Our integrated plan for delivering clean and plentiful water, 4 April 2023, p 65
209 Q253; cf. Rural Payments Agency, Farming Transformation Fund Water Management grant manual, 16 November 2021
210 Q158 [Minette Batters]; Q253 [Judicaelle Hammond]
211 Q6 [Baroness Brown]; Q158 [Minette Batters]; Q253 [Judicaelle Hammond]
212 Q253 [Judicaelle Hammond]; The Country Land and Business Association (ECFS0042)
213 Q269
214 Qq269–270
215 Q271
216 Q272

have access to its water because a golf course two miles down the road has an abstraction licence, which it had historically".[217] He said that Defra was exploring how to "resolve" considerations about historical permits, the environment, economics, and food security.[218]

Conclusions and recommendations on water security

105. **Water management on farms is going to become increasingly important as the climate changes. Using water more efficiently and storing it for use during droughts, as well as managing water demand overall, is going to be critical.**

106. ***The Government must set stronger targets for reducing water demand. We support the Climate Change Committee's recommended target of no more than 100 litres of water per person per day.***

107. **A huge amount of water could be saved by more effectively facilitating the transportation of water from wetter to drier parts of the country.** ***The Government, in collaboration with the devolved administrations, should develop a policy mechanism to transport water more easily and quickly from places where water is plentiful to more water-stressed places.***

108. **Technologies that pinpoint the use of water offer much promise to irrigate farms in a more efficient in targeted way, and should be used more widely. While the Water Management Grant can be used to pay for water efficiency projects, this funding will benefit only a very small proportion of farmers in England.** ***The Government must develop a specific policy mechanism to promote and roll out precision irrigation across the UK farming system. In designing and monitoring the uptake of this mechanism, the Government should mitigate against efficiency paradoxes and report on the impact on water usage.***

109. **We welcome the Government's goal to increase water storage in the agriculture and horticulture sectors by two-thirds by 2050. We also welcome the Government's work on reviewing abstraction licenses and its call for evidence on the planning barriers to small reservoirs. However, food producers clearly feel that the Government is not doing enough nor moving fast enough.** ***To reach its target of increasing water storage by two thirds by 2050, the Government needs an implementation plan that considers and removes barriers in a holistic way, namely: funding, planning, and abstraction.***

Water pollution

110. Last year we published our report on water quality in rivers, and for this inquiry again we heard of the impact of the agriculture sector on water quality.[219] Not only does growing food require clean water, but polluted water also leads to biodiversity loss, which, as we have seen, also threatens our food security. We studied the impacts of farming on water quality extensively in our report last year.[220]

217 Q273
218 Q274
219 Environmental Audit Committee, Fourth Report of Session 2021–22, Water quality in rivers, HC 74
220 Environmental Audit Committee, Fourth Report of Session 2021–22, Water quality in rivers, HC 74, paras 73–129

111. The agriculture sector causes water pollution through the run-off of slurry, fertilisers, and pesticides into our waterways.[221] The run-off of these nutrients causes "eutrophication"—excessive plant and algal blooms in the water. These blooms in turn block the light from penetrating the water, "plunging entire ecosystems into darkness, supressing or eliminating plant and animal populations".[222]

Conclusions and recommendations on water pollution

112. **Poor quality water for farmers affects our food security, and so steps must be taken to reduce the water pollution that the agriculture industry itself causes.** ***We reiterate our recommendations on water pollution caused by agriculture, from our report on Water Quality, that the Government should:***

- ***Commission a five-yearly appraisal of catchment-wide nutrient flows;***
- ***Establish a presumption against granting planning permission for new intensive livestock units where the proposed development would exceed the catchment's nutrient budget, unless there are more robust mitigations in place;***
- ***Intensify work to inspect and remediate large animal slurry stores;***
- ***Independently evaluate the risks to human health and the environment of spreading sewage sludge, and***
- ***Assess and mitigate the risk of microplastic pollution from sewage sludge.***

We ask that in its response to this report, the Government includes an update on the commitments it provided in response to those recommendations.

113. **Currently, nutrients are being lost through leaching into waterways when they could be used to help grow crops.** ***The Government should develop, in collaboration with the devolved administrations and the food and farming supply chains, effective means to transport by-products such as nitrates and phosphates to parts of the UK where they are needed for farming. The Government should monitor the impact of these means on water quality.***

221 Mr James Heyburn (Policy and Engagement Officer at Imperial Policy Forum); Dr Ana Mijic (Director, Centre for Systems Engineering and Innovation at Imperial College London); Dr Athanasios Paschalis (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering at Imperial College London); Ms Elizabeth Fonseca (Research Postgraduate, Centre for Environmental Policy at Imperial College London) (ECFS0012); Sustain: the alliance for better food and farming (ECFS0047)

222 Green Alliance (ECFS0056)

4 Land use

The multiple demands on land

114. Many stakeholders felt that the most central issue to achieving food security in the context of environmental change is the way UK land is used. Land must perform many functions in order to provide food, mitigate climate change, and restore biodiversity. As outlined in our introduction, the principles of mitigating climate change and restoring biodiversity are not necessarily in competition with feeding the population, because mitigating climate change and restoring biodiversity bolsters food security. Nevertheless, the UK's scarce land needs to perform multiple functions which include producing food, providing homes, connecting places through transport infrastructure, sequestering carbon, restoring nature, growing timber and energy crops, generating renewable energy, protecting against floods, and leisure.[223]

Improving productivity

115. One way of managing the multiple functions required of the land is to increase its productivity. Within food production, not all land is equally productive: 57% of UK agricultural output comes from just 33% of farmed land area.[224] In written evidence, Defra argued that "it is possible to target land-use change at the least productive land, to increase the environmental benefit from farming and to increase yields with minimal impact on food production".[225] It said it would achieve this through its Land Use Framework, which we will examine later in this chapter, and through boosting fruit and vegetable production, particularly through controlled environment agriculture, which we will explore more closely in chapter five. However, the James Hutton Institute warned that this approach carries a "risk that further intensification in less productive locations will reduce biodiversity and ecological function".[226]

116. We heard about ways in which farmers are already making their processes more efficient, often by adopting new technologies, such as by using fertilisers more efficiently; improving manure management; improving genetics and livestock health; acquiring and using more data; and reducing the carbon footprint of buildings and machinery.[227] The Minister told us that "UK agriculture has got about 1% more efficient every year … for more than two decades".[228]

117. Professor James Lowenberg-DeBoer argued that improving land use is not a case of either changing or not changing the uses of our land, but doing a mix of both. He said that "there are good reasons to think about changes in land use", which we will outline below, but also that "there are also many opportunities within the current land use to better

223 Q2 [Baroness Brown]; Q48 [Dr Monika Zurek]; Q132 [Henry Dimbleby]; Q180 [Sue Pritchard]; Transforming UK Food Systems Programme (ECFS0013); National Farmers' Union (ECFS0020); WWF-UK (ECFS0065)
224 Defra (ECFS0022)
225 Defra (ECFS0022)
226 James Hutton Institute (ECFS0033)
227 National Sheep Association (ECFS0011)
228 Q262

integrate natural systems".[229] He gave the example of taking large fields with "only a single monocrop", and incorporating several different crops and "natural areas that serve as host areas for predatory insects".[230]

The impact of livestock

118. There were many witnesses who believed that making the land which is used to produce food more efficient will not be enough to adapt the UK's food system to a changing environment or to mitigate the impacts of the food system on the environment. They argued that this is due to the amount of land taken up by rearing livestock, particularly ruminants. Just over half (51%) of UK land is used for grazing or grass for livestock, but it "produces a very small proportion of our food".[231] The Committee on Climate Change predicted in 2020 that, without changes in UK food productivity, 7% more land will be needed to facilitate per capita food supply and settlement growth in the UK by 2035.[232]

119. Dr Elizabeth Boakes pointed to a recent study by the Wellcome Trust that showed:

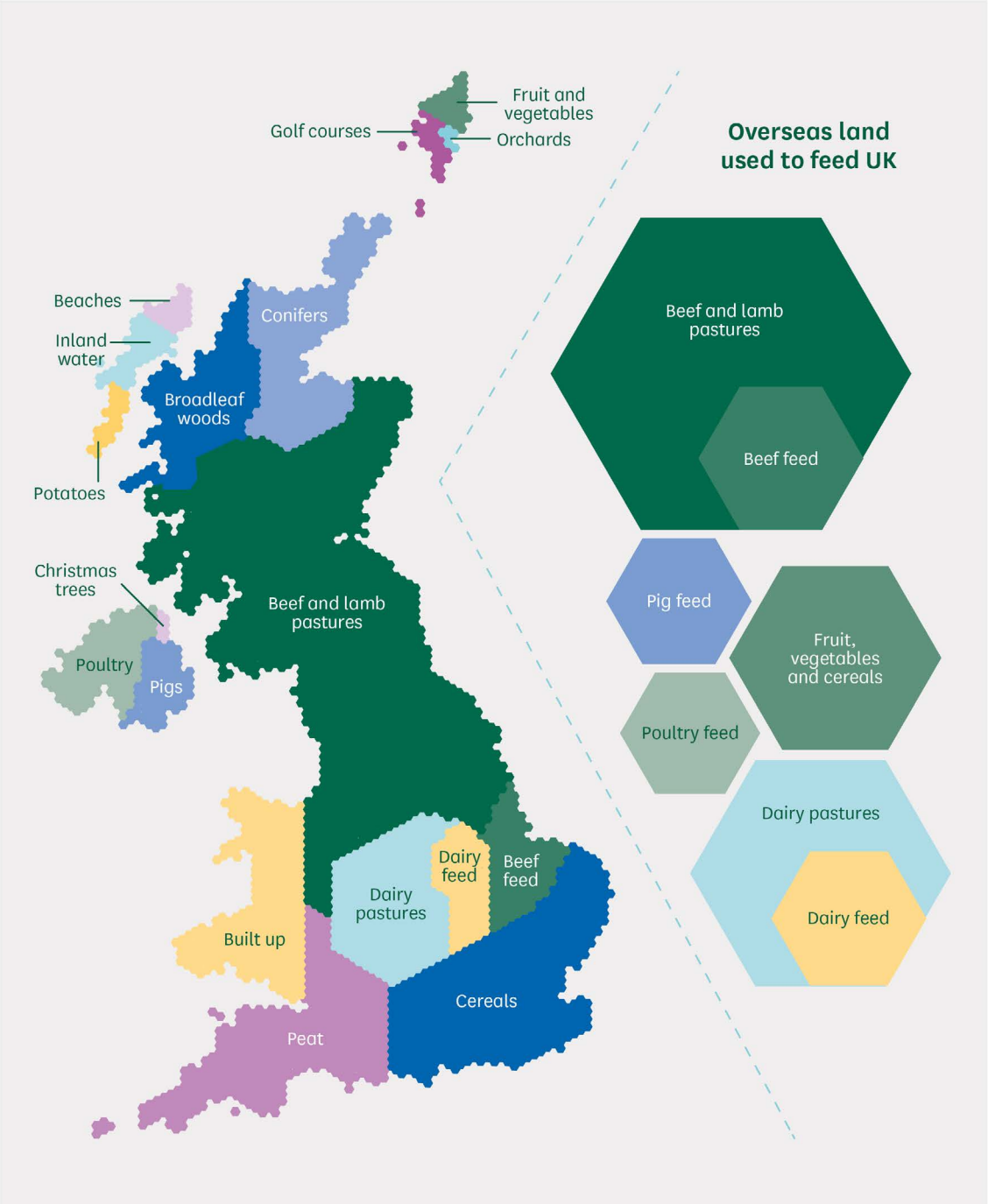
> [I]f we convert just 5% of UK grazing land to arable land, it would produce sufficient calories, via fruits and vegetables, to allow us to free up a further 18% of grazing land to be converted back to a natural landscape. That would increase habitable land for biodiversity by about 10% for 500 UK species, which would boost biodiversity, which in turn would feed back into farmers' yields and would benefit agriculture overall.[233]

Much grazing land is unsuitable for other agricultural uses such as arable or horticultural, but may be suitable for improving biodiversity, forestry, or other uses.[234]

120. The environmental impacts of livestock are not just in the fact that land taken up by animals cannot then be used for other uses, but also in methane emissions and the crops that are grown to feed livestock instead of humans.[235] WWF-UK told us that "[t]he UK's current livestock consumes the equivalent of 10.7 billion loaves of bread and 5.8 billion bowls of porridge per year".[236] When animal feed is taken into account, then the proportion of agricultural land that is used in the UK for feeding and rearing animals is 85%.[237] Several submissions to our inquiry cited a study that showed that this 85% of agricultural land which is used to produce meat and dairy provides only 32% of total calories and 48% of total protein.[238]

229 Q199
230 Q199
231 Q196 [George Monbiot]
232 CCC, The Sixth Carbon Budget: Methodology Report, December 2020, p 221
233 Q52
234 US Department of Agriculture Economic Research Service, How is Land in the United States Used? A Focus on Agricultural Land, 1 March 2012
235 Q20 [Baroness Brown]; Nature Friendly Farming Network (ECFS0024)
236 WWF-UK (ECFS0065)
237 Q125 [Henry Dimbleby]; Feedback (ECFS0035)
238 Henri de Ruiter et al., "Total global agricultural land footprint associated with UK food supply 1986–2011", Global Environmental Change, vol 43, March 2017, pp 72–81; Mr James Heyburn (Policy and Engagement Officer at Imperial Policy Forum); Dr Ana Mijic (Director, Centre for Systems Engineering and Innovation at Imperial College London); Dr Athanasios Paschalis (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering at Imperial College London); Ms Elizabeth Fonseca (Research Postgraduate, Centre for Environmental Policy at Imperial College London) (ECFS0012); Soil Association (ECFS0041); Sustain: the alliance for better food and farming (ECFS0047); Good Food Institute Europe (ECFS0049)

Figure 3: The majority of the UK's land is used for animal pastures and feed



Source: Defra, National Food Strategy: part two, 15 July 2021, p 90

121. The land use issue affects not just the national food system but also the global food system: we heard that feed imports here have "devastating effects" in other parts of the world where that food is produced. For example, in Brazil "an area the size of Spain has been destroyed since the 1960s".[239] At the same time, opting for pasture-fed meat also has environmental consequences. George Monbiot said: "We could eat pasture-fed meat if we had several planets and no space for wild ecosystems on any of them. The global demand for pasture-fed meat is now driving the destruction of the Amazon".[240]

239 Q211 [George Monbiot]; cf. Q52 [Dr Elizabeth Boakes]
240 Q196

122. Owing to the environmental impacts of meat and dairy, many stakeholders argued that less land in the UK should be used for rearing livestock.[241] Dr Elizabeth Boakes said that "one of the only answers" was "getting rid of [some] grazing land".[242] Baroness Brown argued that "eating less meat would mean less land is used overall for agriculture", allowing us to "eat the food crops directly" that are currently grown as feed for animals, and to "make space to grow the trees we are going to need to get us to the "net" bit of net zero".[243]

123. We also learned, both through evidence and through our visit to the National Trust's Wimpole Estate, that there are biodiversity benefits from animal farming, as it provides habitats for certain species and creates green fertiliser.[244] Farmyard manure and grazing within an arable rotation also improves organic matter and thereby soil health.[245] Professor James Lowenberg-DeBoer cautioned us to consider the ecological consequences of reducing grazing land:

> [I]f you remove grazing you change the ecology, and there are certain birds and insects and so on that are disadvantaged and others that will come in. You have a different ecology without grazing. Would a different kind of grazing, a better controlled grazing be a better issue?[246]

124. We also heard about ways to improve efficiency and reduce the emissions of the livestock industry, such as by:

- Investing in slurry management;
- Selectively breeding lineages that produce less methane;
- Using methane-suppressing feed additives;
- Rearing cattle for multiple uses, such as milk and leather rather than beef only, and
- Improving animal health through disease prevention (e.g. vaccination) and animal monitoring technology.[247]

Diet change

125. Closely tied to the amount of land used for livestock is the amount of meat and dairy in our diets. Judicaelle Hammond argued that "it needs to start with the diet, otherwise all we will do is to import meat from elsewhere with possibly even worse consequences".[248] We received evidence that British appetites are already changing, with meat consumption

241 E.g. Jeremy Coller Foundation (ECFS0023); UCL Institute for Sustainable Resources, UCL Centre for Biodiversity and Environment Research (ECFS0029); James Hutton Institute (ECFS0033); Soil Association (ECFS0041); Good Food Institute Europe (ECFS0049); Norwich Research Park (ECFS0053); Grantham Research Institute on Climate Change and the Environment (ECFS0054); Green Alliance (ECFS0056)
242 Q52
243 Q20
244 Q225 [Judicaelle Hammond]; National Farmers Union Scotland (ECFS0010); National Sheep Association (ECFS0011); Game & Wildlife Conservation Trust (ECFS0055)
245 Rodale Institute, Rotational grazing
246 Q208
247 The Country Land and Business Association (ECFS0042); MSD Animal Health (ECFS0058)
248 Q258

falling by 17% in the past decade.[249] Many of our contributors argued that, for reasons of food security and environmental change, we should reduce the amount of meat and dairy we eat, and they added that doing so would have added health benefits.[250] The Climate Change Committee has recommended that if the UK reduced its meat and dairy consumption by 20% by 2030, and by 35% by 2050, it could reduce emissions by 10 MtCO2e by 2050.[251] While George Monbiot advocated that "we [should] basically stop eating animal products", the majority of our evidence suggested not that British people should cut out meat and dairy completely, but merely cut back.[252] A minority, representing farmers and industry, did not support a reduction in meat or dairy consumption.[253]

126. One approach to diet change may be to substitute some meat and dairy with fish. Some suggested that the seafood sector could help to achieve the twin goals of improving food security and reducing the environmental impacts of the food system by introducing different marine species with lower carbon footprints or marine pollution impact into British diets, particularly as a result of the changes to distributions caused by warming oceans. However, they also cautioned that British consumers' preferences for certain fish species—such as cod, tuna, and salmon—are deeply entrenched and difficult to change.[254] In written evidence to us, Defra said that, on inspiring UK consumers to eat more locally caught fish and shellfish, it was "working with stakeholders to better understand issues around supply and consumer behaviour to identify which interventions will be most successful".[255]

127. We also heard that diet is a personal and emotive subject that is bound to our sense of individual identity. Henry Dimbleby described the focus group discussions held for his independent review:

> In all the focus groups we had, when we talked about meat, there were a significant number of people for whom it almost felt like being a meat eater was quite a strong part of their identity … I think there are limited options for a Government that wants to remain in power to move on meat, so we said that the Government should do a few things.[256]

249 Q52 [Dr Elizabeth Boakes]; cf. Q199 [Professor James Lowenberg-DeBoer]

250 E.g. Q20 [Baroness Brown]; Q21 [Richard Millar]; Q47 [Dr Elizabeth Boakes]; Q55 [Dr Monika Zurek]; Q132 [Henry Dimbleby]; Q177 [Sue Pritchard]; Global Sustainability Institute (ECFS0004); Mr James Heyburn (Policy and Engagement Officer at Imperial Policy Forum); Dr Ana Mijic (Director, Centre for Systems Engineering and Innovation at Imperial College London); Dr Athanasios Paschalis (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering at Imperial College London); Ms Elizabeth Fonseca (Research Postgraduate, Centre for Environmental Policy at Imperial College London) (ECFS0012); Professor Neil Ward (Professor, School of Environmental Sciences at University of East Anglia); Professor Tim Benton (Research Director, Environment and Society at Chatham House); Professor Sarah Bridle (Professor of Food, Climate and Society at University of York); Professor Stefan Kepinski (Head of the School of Biology at University of Leeds); Dr Angelina Sanderson Bellamy (Associate Professor of Food Systems at University of West of England) (ECFS0050); Norwich Research Park (ECFS0053); Green Alliance (ECFS0056); WWF-UK (ECFS0065); The Food Foundation (ECFS0067); The Food, Farming and Countryside Commission (ECFS0071)

251 CCC, "The Sixth Carbon Budget: The UK's path to net zero", December 2020, p 165

252 Q196

253 National Farmers Union Scotland (ECFS0010); Dairy UK (ECFS0014); National Farmers' Union (ECFS0020)

254 Q179 [Chris Brown]; The National Federation of Fishermen's Organisations (ECFS0043); WWF-UK (ECFS0065)

255 Defra (ECFS0022)

256 Q135

The role of the state in our diets

128. The Government "does not believe it has a role to tell people what to eat or to tell farmers what to grow".[257] Its strategy is to empower consumers with better information through the Food Data Transparency Partnership. We considered in chapter two the evidence against relying on a better-informed customer to create structural shifts in consumer habits. Several witnesses felt that the Government could do more to encourage more sustainable diets. As Sue Pritchard, Chief Executive of the Food, Farming and Countryside Commission, put it:

> [T]his is not a decision that consumers can be making on a busy Friday night when you are running around the supermarket and trying to make choices about what you choose and how. This is a structural issue … that requires upstream interventions from Government placing the responsibility on businesses to create the right healthy food environment for citizens.[258]

129. We also heard the that the idea that consumers are currently making free choices about their diets is something of a red herring. Professor Tim Lang said:

> Everyone thinks they choose their diet. We don't, actually; we choose it by race, by class, by family, by gender, by culture, by when we were brought up, by the power of advertisers and their expenditure. Nearly £1 billion is spent on advertising food in Britain and it is overwhelmingly the ultra-processed foods that get that advertising. There is very little advertising, let alone national guidance, for eating more appropriately.[259]

Sue Pritchard echoed this, saying:

> Public health say that they find it hard to change diets to more healthy eating, but industry does not find it hard at all. One of the reasons why is that, for every £5 spent on public health education, the industry is spending £200 marketing unhealthy junk food.[260]

130. As well as calling for more controls on food advertising, witnesses said that the Government could encourage more environmentally friendly eating through procurement policy,[261] which we examined in chapter one, and through education in schools,[262] making fruit and vegetables more affordable such as through vouchers for people living in poverty,[263] and publishing national sustainable diet guidance against which contractors could be judged.[264]

131. In its food strategy, the Government commits to a three-year programme of "randomised control trials of interventions in the food system to encourage and enable healthier and more sustainable diets for all", which can then be turned into long-term

257 Defra (ECFS0022)
258 Q177
259 Q57
260 Q177
261 Q20 [Baroness Brown]; Q21 [Richard Millar]; Q135 [Henry Dimbleby]
262 Q20 [Baroness Brown]
263 Q143 [Henry Dimbleby]
264 Q57 [Professor Tim Lang]; WWF-UK (ECFS0065); Eating Better (ECFS0069)

policy.[265] It also refers to developing materials for the school curriculum "and finding opportunities for children and young people to better understand sustainable food and its connection to nature".[266]

132. On the whole, however, we note that the food strategy's chapter on "encouraging healthier and more sustainable dietary choices" leans more heavily on the health aspects. For example, it refers to investing in research in "food and health"; learning from Local Food Partnerships about "addressing food affordability and accessibility to healthy food"; and working with schools "towards a healthier food culture". As we saw above, more sustainable food choices are often healthy choices, so the two are not necessarily in competition; we were nevertheless struck by the strategy's distinction in emphasis.

133. The Minister supported the Government's stance, saying that he does not wish "to dictate what people can and can't eat. That needs to be their free choice".[267] He preferred to focus on the efficiency of meat production such as through breeding cattle to emit less methane, which we will explore more closely in the next chapter. The Minister added that "the marketplace delivers" options for those seeking plant-based options.[268] Rather than promoting an increase in plant-based eating, the Minister said: "we can achieve all these things that you want to achieve without going down that prescriptive route".[269]

The importance of transition

134. A very important point that was raised during our discussions on land use is the need to treat potential changes to land use as a transition, and supporting farmers through that transition. Witnesses explained that livestock farming is an important part of the economic and cultural life of many rural communities and often has been for generations.[270] Any prospective land use change is therefore also "culture change", as Judicaelle Hammond set out:

> If you are a sheep farmer in Cumbria or elsewhere, you know what you are doing with sheep because chances are you are the third or fourth generation to have done it. You would be the first generation to farm for climate or biodiversity.[271]

135. As well as respecting their heritage, we heard that farmers must be supported through any transition both financially and practically, and that both landowners and the public must be given the opportunity to engage and participate.[272] On a practical level, Peter Dawson explained that farmers will need to invest in new infrastructure, which in turn requires a flexible planning system:

> If we are going to have a land use strategy that will change the utilisation of land, [farmers] will have to restructure an enterprise and probably invest in new buildings and other infrastructure that would also have to address the issue of climate change.

265 Defra, Government food strategy, June 2022, pp 23–24
266 Defra, Government food strategy, June 2022, p 24
267 Q283
268 Q285
269 Q286
270 Q53 [Dr Elizabeth Boakes]; Q208 [Professor James Lowenberg-DeBoer]
271 Q258
272 Q180 [Sue Pritchard]; Community Planning Alliance (ECFS0006); National Sheep Association (ECFS0011)

…

> One of the biggest concerns dairy farmers have is that they are running up against local planning restraints that are not allowing them to adapt their businesses. Whatever recommendations the Government come up with in a land use strategy, it has to be harmonised within an appropriate planning framework.[273]

Land Use Framework

136. In response to Henry Dimbleby's independent review of the food system, the Government committed to publishing a land use framework for England in 2023 "that will reflect all our objectives for English agriculture, the environment and net zero".[274] The Dimbleby review had recommended that the Government publish this framework in part to help guide farmers' decisions about how to use their land to meet the Government's net zero and nature targets.[275] The Government also accepted the review's recommendation that the framework should adopt the so-called "three-compartment model" (see Box 1).

Box 1: The three-compartment model of land use

Henry Dimbleby's independent review of the food system recommended that the Government publish a Land Use Framework for England following the so-called "three-compartment model". The three compartments are:

- High-yield farmland, which is farmed intensively, usually in monocrops;
- Low-yield farmland, which is farmed less intensively, sharing the land with nature but requiring more land to produce less food, and
- Semi-natural land, which include priority habitats, heritage or archaeological features, and protected landscapes.

This model combines two approaches to land use—land sparing and land sharing—which, adopted together, have "the broadest beneficial effect for the most species". **Land sparing** involves farming intensively on some farmland so that other land is freed up for nature. **Land sharing** uses the same piece of land to both produce food and sustain nature. Some species thrive better in a land sparing setting; others in land sharing uses; while others prefer a mix of both.

Source: Defra, National Food Strategy Independent Review, Part Two: The Plan, 15 July 2021, pp 98–99

137. Henry Dimbleby told us more about what he hoped a land use framework would achieve:

> Basically, what it has to set out is, first of all, what our land is good to do. That should be on a quite granular level, so that local groups can use it. I literally mean a map that says what land is suited to do what. Then it has to take a view on what we want to happen on which bits of land.
>
> …

273 Q165
274 Defra, Government food strategy, June 2022, p 15
275 Defra, National Food Strategy Independent Review, Part Two: The Plan, 15 July 2021, p 156

> We already pay farmers across the Union £3.4 billion a year for various goods. All this would be doing is saying, "We are now going to use that money to incentivise farmers or landowners to do the things that we think need to be done in each area".[276]

138. Stakeholders broadly welcomed the Government's commitment to a land use framework and the three-compartment model in evidence. We were encouraged to think of the three compartments as a continuum rather than distinct categories; and the framework as "a set of principles and processes for better quality decision making", as opposed to centralised prescriptions about how land should be used around the country.[277] Witnesses said that the land use framework must embed food security and the environment.[278] Sue Pritchard, whose organisation has been working on land use frameworks for several years, said that good data, transparency, inclusion and public engagement were all vital components.[279] Others emphasised the importance of "multifunctionality",[280] including being able to combine renewable energy with controlled environment agriculture, which we will explore more in the next chapter.[281]

139. The Minister assured us that the Government's land use framework is still expected to be published this year.[282] In terms of its contents, he said that "the freedom-loving economist in me does not want to be too prescriptive. I don't think communism works here by dictating to landowners and land managers what they can and can't do with their land".[283] He added that he would prefer to incentivise land owners through carrots rather than sticks. On planning, the Minister said:

> Obviously planning is a matter for DLUHC, which I have no ministerial responsibility for, but it is something that we will be able to use as a tool to have those conversations with DLUHC in terms of how we plan and what we plan and the levers that are available to change how people use their land.[284]

140. In its recent report on food security, the EFRA Committee recommended that the Land Use Framework "should not be overly prescriptive", and should address the balance of land used for pastoral and animal-feed and horticulture.[285] In December 2022 the House of Lords Land Use in England Committee published a comprehensive report on "Making the most out of England's land". Among its recommendations it suggested that the Government's food security report should be informed by its land use framework and that the framework should address the degree to which agricultural innovation can reduce land use pressure.[286] It also recommended that the Government should provide

276 Q138
277 Q139 [Henry Dimbleby]; Q180 [Sue Pritchard]; Institute for Public Policy Research (IPPR) (ECFS0031); Game & Wildlife Conservation Trust (ECFS0055)
278 Q49 [Professor Tim Lang and Dr Monika Zurek]; Q51 [Professor Tim Lang]
279 Qq180–181
280 Q208 [Professor James Lowenberg-DeBoer]; Community Planning Alliance (ECFS0006)
281 Q240 [Edwin Morgan]
282 Q288
283 Q263
284 Q289
285 EFRA Committee, Seventh Report of Session 2022–2023, Food Security, HC 622, para 49
286 House of Lords, Report of the Select Committee on Land Use in England, Session 2022–23, HL Paper 105, paras 45–46

more clarity on planning reform; that the three-compartment model should be treated as a continuum; and that consultation and engagement were important steps in developing the land use framework.[287]

Conclusions and recommendations on Land Use

141. **The Government's commitment to publishing a Land Use Framework for England offers a vital opportunity to ensure that English land performs the many functions required of it, including food production, while also supporting the Government's net zero and nature targets. There is a clear consensus among stakeholders, other select committees, and the Government itself, with which we agree, that the framework should provide a non-prescriptive set of principles for decision-making, and that the three compartments underpinning the framework should be continuous rather than discrete categories.**

142. ***The Minister committed to a publication timetable for the Land Use Framework of this year. We expect the framework to be published no later than the last sitting day in December of 2023 and we expect the framework to balance competing demands on UK land and to integrate fully food security as a central principle. The framework must set out how land will produce food in a way that supports the resilience of our food system while adapting to and mitigating climate change and biodiversity loss. Where feasible, land should be shared to help meet multiple objectives including food production, carbon sequestration, restoring nature, and growing energy crops. The framework must show evidence of having been co-produced with those who are affected by it. Finally, it must also evidence how productivity within existing uses can be improved without negative environmental impacts.***

143. **The success of the Government's forthcoming Land Use Framework is dependent on its harmony with the English planning system.** ***The Government should publish guidance, under the National Planning Policy Framework, to encourage planning authorities to manage applications for land use changes which affect food security on an expedited basis.***

144. **The questions of whether less meat and dairy should be produced in this country, and whether Britons should eat less meat and dairy, are emotive and personal. They cut to the core of our cultures and our identities and have the potential to be polarising. We heard a range of strong opinions. Many argued that people living in the UK should aim to cut down the amount of meat and dairy they consume, and the Climate Change Committee is clear in its advice that across the country meat and dairy consumption should reduce by 20% by 2030 and by 35% by 2050 in order to achieve the Government's net zero target. Others, however, pointed to the ecological benefits of grazing livestock. We are keenly aware that many people's livelihoods in this country depend on livestock farming. That is why** ***we also recommend supporting those farmers who wish to transition to new business practices where necessary and ensuring that their options for producing food in an environmentally sustainable way are commercially viable and culturally considerate.***

287 House of Lords, Report of the Select Committee on Land Use in England, Session 2022–23, HL Paper 105, paras 186, 199 and 221

145. ***In its Land Use Framework, the Government, informed by the evidence we have received for our inquiry, should set out whether the UK can continue production at current levels, or should seek to increase domestic food production to enhance food security, while also meeting its targets on net zero and biodiversity. To do so it should publish alongside the Land Use Framework its methodologies for calculating how these potentially conflicting objectives will be met.***

146. **The Government does not want to tell people what to eat, but from its plans to encourage people to eat more healthily it clearly understands its role in helping people make better choices. In any case, if the Government will not tell people what to eat, the advertising industry will: we heard that for every £5 spent on public health education, £200 is spent on junk food ads. We welcome the Government's plans in its food strategy to encourage more sustainable eating, but there is more that it can do without being prescriptive.** ***In addition to our recommendations on public procurement, we recommend that the Government should publish national guidance on sustainable diets within the next twelve months. The Government's plans for a strong food curriculum in schools should include science-based education about the environmental impacts of food production, including food waste. The Government's work on UK consumer seafood habits should explore how to encourage consumers to eat a wider variety of more sustainable species.***

5 Building food system resilience

Innovation in food production

147. As we saw in chapter one, our evidence strongly suggested that the solution to building resilience in the food system is to reduce concentration in the system by introducing more diversity. One of the areas in which we heard that more diversity is required is in producing food using a range of different methods and farming techniques. The many approaches we heard about span a spectrum from more traditional practices to developing new-age technological innovations that can minimise the environmental impacts of food.

148. James Young told us that such practices, far from being an added cost, can even have a cost benefit. He gave the example of McCain paying the cost of cover crop seeds for its growers, a practice which ensures that the soil is not bare in between the potato crop rotation. This reduces soil erosion and ultimately makes the potato crop more productive. He said that "the improvement in the soil health in between the potato crop over a long period of time should pay for itself".[288]

149. In this chapter we will set out the benefits of different types of food production practices, before highlighting where further research is needed and crucially how to translate that research to farms. Finally, we will analyse the Government's Environmental Land Management schemes, which are a critical lever in the shift towards producing food in a way that provides food security and meets the Government's environmental goals.

Agroecology

150. Many contributors to our inquiry supported agroecological approaches to food production.[289] Agroecology is an umbrella term that covers several agricultural practices. If ecology is "the study of relationships between plants, animals, people, and their environment", then agroecology is "the application of ecological concepts and principles in farming".[290] Agroecological farming practices include organic farming, intercropping, and crop rotations.[291]

151. Research commissioned by the Food, Farming and Countryside Commission found that agroecology "helps us to tackle several crises simultaneously" because it can "reduce emissions by upwards of 70% and restore biodiversity across the whole of the farm landscape".[292] The Climate Change Committee's March 2023 progress report on adapting to climate change recommended that more funding support was required for agroecology, as well as further research and development on agroecology.[293] In its evidence, the Landworkers' Alliance Farmers Union echoed these recommendations and called on the Government to "outline a clearer pathway towards increasing the amount of land under agroecological production".[294]

288 Q100
289 E.g. Floodplain Meadows Partnership (ECFS0046); McCain Foods (GB) Ltd (ECFS0039); The Country Land and Business Association (ECFS0042); The Food, Farming and Countryside Commission (ECFS0071)
290 Soil Association, "What is agroecology?"
291 Food and Agriculture Organization of the United Nations, The 10 elements of agroecology: guiding the transition to sustainable food and agricultural systems
292 Q166 [Sue Pritchard]
293 CCC, Progress in adapting to climate change: 2023 Report to Parliament, March 2023, p 83
294 Landworkers' Alliance - Farmers Union (ECFS0017)

Agroforestry

152. Agroforestry is an example of agroecology that involves planting trees, shrubs and hedges on farms.[295] It can include grazing animals under trees, growing crops beneath trees, hedgerows, and buffer strips. According to the Soil Association, the trees provide habitats for wildlife including natural predators of crop pests, simultaneously helping to restore biodiversity and reducing the need for pesticides.[296] They also can be harvested if a crop fails. In evidence, the Soil Association was enthusiastic about the benefits of agroforestry for soil health, because the tree roots hold the soils firm, buffering against erosion, while the falling, rotting leaves feed the soil with additional organic matter.[297]

153. Guy Singh-Watson described his experience of practising agroforestry on his farm, where he grows walnut and hazelnut trees among grass which is grazed. He informed us that "the nuts will produce roughly four times per hectare what the beef will produce in terms of edible protein", while the trees "also sequester carbon and foster biodiversity".[298] The Landworkers' Farmers Association suggested that in the east of the UK, where more extreme droughts are predicted, agroforestry techniques may be able to both "remediate exhausted soils" and "raise water tables".[299]

Regenerative farming

154. We also received support for regenerative farming practices, another subset of agroecology.[300] According to the World Economic Forum, regenerative farming focuses on improving soil health, such as through minimising the ploughing of land, rotating crops, and moving grazing animals to different pastures.[301] We heard that many UK farmers already use regenerative farming techniques—McCain has committed to adopting regenerative farming across 100% of its crop by 2030, developing a framework of guidelines and training programmes for its growers to achieve this goal.[302] Regenerative farming techniques that are already being practised include: cover cropping, ensuring no bare soil in the rotation, rotating green-manure crops, using organic fertilisers where possible, reducing pesticides, planting wildflower mixes in areas that are unproductive, and regenerative grazing techniques such as knitted-swards.[303] Such techniques, one US study cited by the Soil Association found, produce yields up to 40% higher than conventional farms in times of drought.[304]

155. We received some criticism not of regenerative farming itself, but of the fact that the term is so wide-ranging as to include practices that are less than beneficial for the environment. Guy Singh-Watson said:

> [Regenerative farming] can mean anything from organic-plus, which I would absolutely support, to simply not ploughing, which almost inevitably involves using large amounts of glyphosate … It may have some

295 Soil Association, "What is agroforestry?"
296 Soil Association, "What is agroforestry?"
297 Soil Association (ECFS0041)
298 Q97
299 Landworkers' Alliance - Farmers Union (ECFS0017)
300 Q166 [Sue Pritchard]; Community Planning Alliance (ECFS0006); McCain Foods (GB) Ltd (ECFS0039)
301 World Economic Forum, "What is regenerative agriculture", 11 October 2022
302 McCain Foods (GB) Ltd (ECFS0039)
303 Qq85–86; Q100; Landworkers' Alliance - Farmers Union (ECFS0017); McCain Foods (GB) Ltd (ECFS0039)
304 Soil Association (ECFS0041)

> environmental benefits by reducing ploughing, but the breadth of farming practices that are using this term are just so ludicrously wide that I think it is meaningless.[305]

Urban and community horticulture

156. As well as useful innovations in open-field agriculture, there was support in evidence for the UK's towns and cities to contribute to food security through community growing or "urban horticulture".[306] Urban horticulture is "the production of fruits and vegetables in cities in towns" in sites such as allotments, community and domestic gardens, roofs, and wider greenspace such as parks.[307] Like many agroecological practices that are a return to more traditional methods, urban horticulture also used to be practised more widely in this country. During World War Two, British households grew 18% of the country's fruit and vegetables, but that has reduced to 3% today.[308]

157. Dr Jill Edmondson, Senior Lecturer in Biosciences at the University of Sheffield, specialises in urban horticulture. She informed us of many the environmental benefits of community growing, saying that it can:

- contribute to urban cooling;
- provide hotspots for pollinator biodiversity;
- reduce transport distances in the food supply chain;
- offer opportunities for recycling waste and rainwater that rushes off urban buildings;
- mitigate flooding, and
- have higher carbon capture and be better for soil health than conventional farming.[309]

158. In terms of food supply, Dr Edmondson's team's research found that a small increase in urban horticulture could significantly increase the proportion of fruit and vegetables—80% of which are currently imported—grown locally. The researchers found that if, in addition to allotments currently in use, urban horticulture was practised in 10% of domestic gardens and expanded into 10% of the additional land identified in their study, then 15% of Sheffield's population could obtain their five daily portions of fruit and vegetables from urban horticulture, compared to 3% currently.[310]

159. In addition to the benefits for food security and the environment, Dr Edmondson also outlined the significant "co-benefits" of urban horticulture. These include improving the mental health of growers and connecting urban dwellers with nature; improving the

305 Q89
306 E.g. Food Ethics Council (ECFS0062); CPRE the countryside charity (ECFS0063)
307 Dr Jill Edmondson (Senior Lecturer, School of Biosciences at The University of Sheffield) (ECFS0072)
308 Dr Jill Edmondson (Senior Lecturer, School of Biosciences at The University of Sheffield) (ECFS0072)
309 Q235; Q246; Q257; Dr Jill Edmondson (Senior Lecturer, School of Biosciences at The University of Sheffield) (ECFS0072)
310 Dr Jill Edmondson (Senior Lecturer, School of Biosciences at The University of Sheffield) (ECFS0072)

diet and health of the local population by increasing fruit and vegetable consumption; providing local career opportunities and skills development; and helping to relieve labour supply issues in rural areas.[311]

160. Witnesses including Dr Edmondson herself did not advocate urban horticulture to replace the need for rural farming, instead arguing that it should be in the mix as part of a diverse food system.[312] Baroness Brown said that the Climate Change Committee was "cautious" about "how big an impact it will have on food security" but still regards urban horticulture as "hugely important because of how good it is for people from the health and wellbeing benefits".[313] She added that being able to integrate urban green space with producing food is a "win-win",[314] while the Landworkers' Alliance Farmers Union felt that the Government's food strategy should have addressed urban horticulture.[315]

161. To realise the benefits of urban horticulture, Dr Edmondson argued that the two most important enablers were equipping locals with the skills needed to start growing, and having security of spaces available for growing. Since the mid-twentieth century, 60% of allotment land has been lost while "allotment waiting lists have increased year on year in the UK since the turn of the century", and there has been eight times more loss in areas of high deprivation.[316] The challenge is the population density of urban areas and the multiple demands on urban greenspace, but Dr Edmondson argued that if horticulture is "integrated well" it can provide "important benefits" even to those who do not participate in the growing.[317] She argued that the space is available: half of the 20,000 sq km of urban area is green space,[318] and there is great potential too in urban grey space such as the flat roofs on buildings.[319] She called for Government policies to secure the provision of land for urban horticulture, particularly for community-led businesses who have less security in land than allotments which are protected by law.[320]

162. If more space becomes available for community growing, Dr Edmondson argued, then "we need to increase the skillset as well": lack of knowledge about growing was a key barrier for the deprived communities with which she worked in Sheffield.[321] She called for specific policies to support the development of "skills, expertise and knowledge" of growing.[322]

Controlled environment agriculture

163. Several witnesses were enthusiastic about the potential of controlled environment agriculture to contribute to food security in a changing environment.[323] Controlled environment agriculture is a modern type of farming whereby crops are grown indoors

311 Q227; Q235; Q245; Q247; Dr Jill Edmondson (Senior Lecturer, School of Biosciences at The University of Sheffield) (ECFS0072); cf. James Hutton Institute (ECFS0033)
312 Q234
313 Q22; cf. Dairy UK (ECFS0014)
314 Q23
315 Landworkers' Alliance - Farmers Union (ECFS0017)
316 Q228
317 Q235
318 Q226
319 Q234
320 Q249
321 Q229; Q247
322 Q249
323 E.g. James Hutton Institute (ECFS0033)

under tightly controlled conditions such as the temperature, lighting, humidity, irrigation, and nutrients.[324] Another name for it is "vertical farming", owing to the vertically stacked layers of crops. Currently, vertical farming produces a few thousand tonnes of about 3 million tonnes of fruit and vegetables produced in the UK each year.[325]

164. We took evidence from Edwin Morgan, Director of Communications at Harvest London. Harvest London is a vertical farm that supplies fresh herbs and salads to the restaurant, food service, and manufacturing sectors. It uses a hydroponic system, which grows plants without soil, instead feeding the plants with nutrients dissolved in water.[326] Mr Morgan described the benefits of controlled environment agriculture as follows.

165. Because the growing conditions are controlled, crops that usually cannot be grown in the UK, or cannot be grown out of season, can be grown all year round.[327] This provides a reliable supply of items that are regularly imported, such as salad; Dr Monika Zurek added that this can diversify the types of food that are available in a given location, particularly urban areas.[328] It is more productive as a result of the controlled conditions: Harvest London's newest farm will produce 63 times the volume of salad per hectare as a British field.[329] It does not have the same problems with agricultural runoff of nutrients into waterways that open field agriculture has, and also uses less water.[330] Since food is grown locally, it reduces the risk of transport disruption, reduces airmiles, and is fresher.[331] Mr Morgan painted a picture of herbs arriving on a restaurant diner's plate within four hours of being harvested, and Thai basil, which is native to southeast Asia, growing in London.[332]

166. Vertical farming can also support other parts of the food system. Mr Morgan described vertical farms being used to accelerate the growth of tree seedlings before being moved into an orchard.[333] Baroness Brown set out "a real opportunity" for Scottish broccoli:

> It can be difficult to grow brassicas in Scotland because at the early stages of growth some of the severe and very wet weather makes them rot. If you can grow them in vertical farming systems until they reach a critical size and then plant them out in the field, you can start growing broccoli extensively in Scotland.[334]

There is also a role for controlled environment horticulture in community growing: Dr Jill Edmondson found that using 10% of flat roofs on Sheffield to grow fruit and vegetables using a hydroponic system could generate 2% of the population's fruit and vegetable demand for the year.[335]

167. Controlled environment agriculture is a relatively new way of farming that has expanded in the last ten years and we heard that it has "considerable scope to grow"

324 Harvest London (ECFS0073)
325 Q231 [Edwin Morgan]; Defra, Horticulture statistics - 2022, updated 13 June 2023
326 Royal Horticultural Society, Hydroponics
327 Q230
328 Q58
329 Q230; cf. James Hutton Institute (ECFS0033)
330 Q230; Q238; Q257
331 Q230; Q245
332 Q230
333 Q244
334 Q22
335 Q244

further;[336] we received an estimate that globally the sector will double in value from 2022 to 2027, from approximately $15 billion to over $30 billion.[337] As with urban horticulture, we heard that the point was not to replace traditional agriculture, as "we are probably not going to grow lots of cereal crops or root vegetables in vertical farms, and British farming will handle that very well", but again that it can add resilience as part of a diverse food system.[338]

168. The main barrier and drawback to growing the vertical farming sector is that it is necessarily energy intensive to be able to control the growing conditions. According to the 2021 Global CEA [Controlled Environment Agriculture] Census Report, vertical farms average 38.8 kilowatt hours per kilogram of produce, compared to 5.4 kilowatt hours per kilogram of produce grown in greenhouses.[339] A study comparing lettuces grown in a vertical farm and an open-field farm the Netherlands found that the carbon footprint of the vertical farm was 5.6–16.7 times greater than that of the conventional farm; this drops to 2.3–3.3 times when taking into account lost carbon sequestration potential by land-use change, identical packaging, and renewable energy usage.[340] Edwin Morgan argued that to alleviate the energy issue, the land use framework should enable solar and wind farms to be combined with vertical farms.[341] He also underlined the importance of the Government's goal to decarbonise the electricity grid by 2035, a commitment we are currently scrutinising in our inquiry into *Enabling sustainable electrification of the UK economy*.[342]

169. As well as the energy issue, Mr Morgan called on the Government to bring the sector's eligibility for innovation and business rates reduction in line with the rest of the food production sector.[343] His company's farms use no pesticides but cannot be classed as organic because produce is not grown in soil: he called for a designation system that allows produce grown in controlled environment agriculture to be classed as organic or 'post-organic'.[344]

170. The Government's food strategy states that it will "create a positive investment environment" for what it calls "industrial horticulture" by including it "alongside other manufacturing sectors in decisions on industrial energy policy" and by reviewing the planning permission process to support new developments.[345] It adds that it will develop a horticulture strategy that will include controlled environment horticulture within its remit, however, plans for that strategy have since been dropped.[346]

336 Harvest London (ECFS0073)
337 James Hutton Institute (ECFS0033)
338 Q233 [Edwin Morgan]
339 Agritecture LLC and WayBeyond Ltd, 2021 Global CEA Census Report, p 46
340 T. Blom et al., "The embodied carbon emissions of lettuce production in vertical farming, greenhouse horticulture, and open-field farming in the Netherlands", Journal of Cleaner Production, vol 377, 1 December 2022
341 Q240
342 Q240
343 Q239
344 Q242
345 Defra, Government food strategy, June 2022, pp 16–17
346 Defra, Government food strategy, June 2022, p 17; HC Deb, 2 May 2023, UIN 182809 [Commons written answer]

Technological innovations

171. Throughout our inquiry we heard that harnessing the potential of new technologies could help to improve productivity and reduce the environmental impacts of food production, contributing to food security. George Monbiot argued that new technologies are an essential component, stating: "unless we develop the necessary technologies that make it easy for us to substitute the most damaging products, we make it much harder for ourselves".[347]

172. Some of the technological advances aim to reduce the environmental impacts of livestock. We heard about feed additives that can reduce the amount of methane emitted by animals.[348] Sue Pritchard described technological innovations in manure and nutrient management, "where litter goes in at one end and out the other end comes a very saleable product that is easily transported to other parts of the country", providing "economic opportunities" to profit from waste.[349]

173. Other innovations have to do with alternatives to meat. Henry Dimbleby described three kinds of alternatives: plant-based substitutes, fermented proteins, and lab-grown—or "cultivated"—meat.[350] He described a lab-grown meatball that he sampled as tasting exactly like pork, but felt that it will never "be cheap enough to take a lot of room"; the Minister also pointed out that "the energy that is required to do that at the moment is huge".[351] Mr Dimbleby was more bullish about the alternative proteins, which he argued should be used in processed food which "we eat so much" of anyway.[352] We received evidence that plant-based meat substitutes produce 98% fewer emissions and use up to 93% less land and 99% less water than conventional meat.[353] However, it has recently been reported that sales of meat alternatives are down by 13.6% over the past year in the UK, so it is unclear whether consumer demand will enable take up.[354]

174. Other technological innovations that we heard about include:

- Gene editing and genetic engineering (developing breeds that are more resilient to environmental change and that help to reduce emissions);[355]
- Using artificial intelligence to see every plant in a field and pin-point where fertiliser or pesticide must be used;[356]
- Using robots or drones to weed, apply agro-inputs, or to grow crops in strips instead of large field monocultures;[357]

347 Q220
348 Q29 [Baroness Brown]; Q255 [Judicaelle Hammond]
349 Q173
350 Q136
351 Q136; Q301
352 Q136
353 Good Food Institute Europe (ECFS0049)
354 "Demand for vegan food plummets as meat sales soar", Grocery Gazette, 20 November 2023
355 Q29 [Baroness Brown]
356 Q143 [Henry Dimbleby]; Q217 [Professor James Lowenberg-DeBoer]
357 Q143 [Henry Dimbleby]; Q197 [Professor James Lowenberg-DeBoer]; CropLife UK (ECFS0059)

- Using remote sensing to give widespread environmental indicators rather than small samples, or to monitor storage conditions to ensure food is kept fresh and not wasted,[358] and
- Producing fertilisers and bioenergy from agricultural and industrial waste.[359]

175. Witnesses also told us about the potential to combine cutting edge technologies with traditional or more nature-based methods of farming.[360] Professor James Lowenberg-DeBoer told us that this is what sets apart new technologies from the mechanical era:

> In the past, with mechanisation, that favoured large roughly rectangular fields and eliminating other kinds of hedgerows and in-field trees and so on. With autonomous machinery, with AI [artificial intelligence], with agritech, we can do a much better job of integrating different kinds of crops and plants into the same planting systems, producing resilience but also allowing room for biodiversity and all the benefits that that brings with it.[361]

Judicaelle Hammond concurred that "there is a spectrum", saying that some traditional regenerative agriculture "is totally obsessed with data" provided by artificial intelligence and sensors, and that "even in regenerative and agroecology, you need some of the very cutting edge practices".[362]

176. Indeed, some warned that technological approaches alone were not "silver bullets" and should be incorporated within a wider, nature-integrated approach, rather than used to supplant agroecological farming or "to further increase intensification of the farmed environment".[363] Contributors called for new technologies to be transparent, peer-reviewed, publicly consulted on, trialled, and appropriately regulated to ensure that they contribute to the public good.[364] George Monbiot's warning about efficiency paradoxes, whereby an increase in efficiency may counter-productively lead to an increase in the consumption of resources, bears repeating here.[365]

177. Among the Government's commitments on supporting technological innovation on food production, its food strategy refers to the Genetic Technology (Precision Breeding) Act 2023, through which the Government intends to "create a new simpler regulatory regime to allow researchers and breeders to unlock the benefits of technologies such as gene editing" in England.[366] Following the UK's departure from the European Union, the strategy also commits to working with the Food Standards Agency "to develop dedicated guidance materials for approval of new alternative protein products while reviewing

358 Q222 [Professor James Lowenberg-DeBoer]; University of Essex (ECFS0009)
359 CCm Technologies (ECFS0002); Anaerobic Digestion and Bioresources Association (ADBA) (ECFS0038)
360 E.g. Nature Friendly Farming Network (ECFS0024)
361 Q194
362 Q256
363 E.g. Landworkers' Alliance - Farmers Union (ECFS0017); Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)
364 Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018); National Farmers' Union (ECFS0020); Nature Friendly Farming Network (ECFS0024); Institute for Public Policy Research (IPPR) (ECFS0031)
365 Q206
366 Defra, Government food strategy, June 2022, p 20

our novel food regulations".[367] The Government has also launched a call for evidence on methane suppressing feed products.[368] The Minister described as "genuinely exciting" the various technologies that are being developed, and Tessa Jones said that technological innovation was a "big focus" for the Government in terms of "supporting those skills and expertise".[369]

Research on food system resilience

178. An important enabler for building resilience into the food system is investing in research. We heard that there are some research fields in which the UK is particularly strong. These areas include autonomous machinery, artificial intelligence, agri-tech, and vertical farming.[370] There were other areas where contributors called for more research and development, in fact so many that we have decided to include these in an annex to this report. These suggestions span topics such as farming practices, understanding the impacts of climate change and biodiversity loss on food security, new technologies, social factors, and much more.

179. The Government's food strategy highlights a £120 million investment in research across the food system in partnership with UK Research and Innovation (UKRI), and outlines the Government's strategy for identifying priority areas for funding:

> We will work with UKRI, industry and consumer groups to develop joint priority areas for funding, including regional priorities, and proposals to access this, for example on industry automation and alternative proteins. We are also working with UKRI to maximise the reach of industry-led collaborative R&D to SMEs across the UK.[371]

Transferring research to farms

Educational support and training

180. "The Government have to find a way of bringing [farmers] on board if they do want to achieve a degree of change", said Peter Dawson in evidence.[372] We heard that while some farmers "lean in" and "invest in all the latest technology", others have less access to information and knowledge and need more opportunities for education and training.[373] Professor James Lowenberg-DeBoer told us that compared to other countries, the process from transferring research to farms in the UK is fragmented:

> [T]he key element is reducing the fragmentation in the process of transferring science and technology from laboratories and research to farms. The UK is unusual among its other industrialised country competitors in having almost no public sector extension or farm advisory service. While those

367 Defra, Government food strategy, June 2022, p 20
368 Defra, Methane suppressing feed products: call for evidence, 23 August 2022
369 Q296; Q300
370 Q194 [Professor James Lowenberg-DeBoer]; Q237 [Edwin Morgan]
371 Defra, Government food strategy, June 2022, p 19
372 Q184
373 Q10 [Baroness Brown]; Q143 [Henry Dimbleby]; Q145 [Henry Dimbleby]

> services have diminished over time in many parts of the world, they still play a very crucial role in the US and other places in facilitating the overall system. The UK does not have that.[374]

181. Access to third parties came up as a possible solution. Professor Lowenberg-DeBoer advocated having "a third party evaluator and a facilitator",[375] while Guy Singh-Watson suggested that the Government should invest in enabling farmers to have an ecologist come to their farms, which would be both informative and "motivating".[376]

182. On the uptake of new technologies, we heard that to ensure new technologies are adopted they must work well; be profitable; be sufficiently recognised for their public good outcomes to outweigh their cost; and be developed with farmers, and that farmers must have access to good broadband and mobile network coverage.[377]

Financial support

183. As we saw in the chapter on land use, any changes to food production practices have the potential to affect farmers' livelihoods. Professor Lowenberg-DeBoer highlighted that any negative impact on farmers' livelihoods could counterproductively affect our food security: "If farmers cannot support their families by producing food, the whole food system is undermined".[378] However, this also provides an opportunity: Judicaelle Hammond told us that "anything is possible as long as farmers and other land managers can see a viable commercial alternative".[379] George Monbiot argued that "farming is in a much better place to have a just transition than virtually any other industry because we are spending £3.4 billion a year in the UK on farm subsidies. We can simply pay people to do something differently".[380] We also heard that it was important that access to advisory services should be free of charge.[381]

The Government's work on transferring research to farms

184. The Government's food strategy outlines how it intends to impart knowledge to farmers, connect industry to farms, and enable farmers to take up new technologies. It commits to launching a new Institute for Agriculture and Horticulture this year to help farmers with skills development.[382] It also commits the Agriculture and Horticulture Development Board to developing a What Works Centre to share best practice across the industry, following a recommendation by Henry Dimbleby to improve the advice available to farmers.[383] In evidence the Minister said that negotiations were ongoing to ensure that membership levies for these organisations are "at a level that is comfortable for producers".[384] He said he would "sincerely hope" that through these bodies, farmers

374 Q216; cf. National Farmers' Union (ECFS0020); Nature Friendly Farming Network (ECFS0024)
375 Q216
376 Q96
377 Q218 [Professor James Lowenberg-DeBoer]; Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018); National Farmers' Union (ECFS0020)
378 Q188
379 Q258
380 Q210
381 The Food Foundation (ECFS0067)
382 Defra, Government food strategy, June 2022, p 15
383 Defra, Government food strategy, June 2022, p 15
384 Q298

will be able to obtain advice tailored to their local area, but added that there are also many other groups who can provide tailored advice such as the Royal Society for the Protection of Birds, the Farming and Wildlife Advisory Group, and Natural England.[385]

185. The Government's food strategy refers to the Government's Farming Innovation Programme, which will invest £270 million from 2021 to 2029.[386] In written evidence Defra explained that this programme aims to involve farmers, growers, and agri-food businesses in agricultural R&D, and that recent thematic competitions for funding covered climate change and sustainability.[387] Tessa Jones described this programme as "genuinely at the cutting edge of opportunities for research and development".[388] Defra's written evidence also refers to the Government's Farming Investment Fund, which provides grants for equipment and technology as well as larger investments such as on-farm reservoirs (the Water Management Grant, discussed in chapter three, is part of this programme).[389]

186. Finally, the Government's food strategy says:

> We will build on existing work with geographically diverse academic institutions and innovation providers to connect industry with innovation expertise, showcase companies leading the way in adoption of new technologies, and host R&D collaborations.[390]

It continues that it will offer specialised regional support and engagement with small and medium-sized enterprises in the food and drink sector.[391]

Natural capital markets

187. The countryside charity CPRE and the Country Land and Business Association mentioned the role that private finance, via carbon credits, could play in determining how land is used and managed.[392] The Country Land and Business Association wrote:

> Private-sector environmental markets will become increasingly important in meeting net-zero and biodiversity net-gain targets. The government should ensure that these emerging markets are robust–for example, by establishing standards for measurement, reporting and verification–and that they do not lead to perverse and/or irreversible changes in land use which damage future food security.

We are exploring the role of private investment in measures to support nature recovery in our inquiry into *The role of natural capital in the green economy.*[393]

385 Q299
386 Defra, Government food strategy, June 2022, p 10
387 Defra (ECFS0022)
388 Q300
389 Defra (ECFS0022)
390 Defra, Government food strategy, June 2022, pp 19–20
391 Defra, Government food strategy, June 2022, p 20
392 The Country Land and Business Association (ECFS0042); CPRE the countryside charity (ECFS0063)
393 Environmental Audit Committee, The role of natural capital in the green economy

Environmental Land Management schemes

188. Through our inquiry we learnt that a critical lever in incentivising a shift towards achieving food security in the context of environmental change is the Government's Environmental Land Management schemes (ELMs), which pay farmers to do certain things with their land (see Box 2). These schemes arise from the Agriculture Act 2020, the legal framework that the UK established after leaving the European Union and therefore the EU's Common Agricultural Policy.

189. The Government describes ELMs as being "founded on the principle of 'public money for public goods'".[394] Under the Agriculture Act 2020, Ministers have powers to pay farmers to take actions including to improve the environment—so-called "public goods" for which the market does not necessarily compensate. The new ELM schemes are being phased in over a seven-year period from 2021–2027. During this time, payments based broadly on how much land is farmed are being replaced gradually with new ELM schemes.[395]

Box 2: Environmental Land Management schemes

Under ELMs there are three pillars:

1. The **Sustainable Farming Incentive** scheme replaces the direct payments to farmers through the Basic Payment Scheme under the Common Agricultural Policy. It offers farmers a range of options to undertake certain environmentally beneficial actions, such as maintaining hedgerows or managing soil quality.
2. The **Countryside Stewardship and Countryside Stewardship Plus** scheme evolves the original Countryside Stewardship scheme under the Common Agricultural Policy. It pays for activities that support local nature recovery and meet local environmental priorities.
3. The **Landscape Recovery** scheme funds long-term projects that support landscape and ecosystem recovery.

Source: Defra, Environmental Land Management update: how government will pay for land-based environment and climate goods and services, January 2023

190. The overall feedback that the Committee received on ELMs, which has been under development throughout our inquiry, is that it is a step in the right direction but more clarity and certainty is required in relation to what farmers need to do, the amount of funding available, and how ELMs will support the Government's goals for food security and environmental protection.[396]

191. Contributors suggested that ELMs need to be much more explicitly linked to the Government's environmental goals, including those to which it has committed in

394 Defra, ELM Policy Discussion Document, February 2020

395 See further: *Farming funding: implementing new approaches*, Commons Briefing Paper CBP-9431, House of Commons Library, 15 March 2023

396 Q95 [James Young]; Q153 [Sue Pritchard]; Q236 [Judicaelle Hammond]; The Country Land and Business Association (ECFS0042)

legislation.[397] For example, the National Farmers' Union pointed out that there are no specific measures in the Sustainable Farming Incentive to support farmers to reach net zero.[398]

192. It was also argued that ELMs need to include food production and food security more explicitly. Professor Tim Lang pointed out that the policy guidance on ELMs "does not even deem food to be a public good", which he found "staggering"; we also received evidence that farmers are critical of the absence of food production from ELMs policies.[399] Professor James Lowenberg-DeBoer distinguished between food itself as a private good but food security as a public good, saying:

> I remind the Committee that in many ways food security is a public good. Food itself is private—if you eat it, I cannot eat it—but food security in the sense that the whole society is going to have enough food is a social creation.[400]

193. Contributors suggested a range of activities that could be supported through ELMs in pursuit of food security and environmental protection:

- Locally produced food;
- Community supported agriculture;
- Wetland creation;
- Water storage and water efficiency;
- Agroecology and regenerative farming;
- Combining vertical farming with existing farms to free up space for rewilding;
- Working in conjunction with the carbon market;
- Carbon storage of grasslands;
- Organic manures;
- Reduced cultivation regimes, and
- Greenhouse gas footprinting.[401]

194. The Government's policy discussion document on ELMs stated that ELMs would pay for the following public goods, among which neither food itself nor food security is included:

397 Q81 [Richard Millar]; Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)

398 National Farmers' Union (ECFS0020)

399 Q62; Transforming UK Food Systems Programme (ECFS0013)

400 Q188

401 Landworkers' Alliance - Farmers Union (ECFS0017); Wildlife & Countryside Link, RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018); National Farmers' Union (ECFS0020); Sustain: the alliance for better food and farming (ECFS0047); Q239 [Edwin Morgan]

- clean and plentiful water;
- clean air;
- protection from and mitigation of environmental hazards;
- mitigation of and adaptation to climate change;
- thriving plants and wildlife, and
- beauty, heritage and engagement.[402]

195. When it submitted evidence to us in December 2022, the National Farmers' Union said that take up of the Sustainable Farming Incentive was "low", corresponding to "farmers' disappointment" at their ability to "earn funding" from the scheme.[403] In evidence in July 2023 the Minister was positive about the reception of ELMs in the farming community. He said that the Government had promoted the schemes "at nearly every major agricultural show this summer", and that since the Government had published more detail on the Sustainable Farming Incentive in June, there "has been a change in enthusiasm" among farmers.[404] On 18 September 2023, the Government invited applications for a "new and improved" Sustainable Farming Incentive, which had been "expanded and made more flexible in response to farmer feedback".[405] The scheme has a rolling application window and, according to a recent written answer, had received 2,737 applications as of 16 November 2023.[406] Data on take up of the scheme are not published regularly and comparable statistics from the previous year are not available. However, the Agriculture and Horticulture Development Board is reported to have said that the most recent update "offers farmers much more flexibility in terms of choosing actions which suit their farms.[407]

196. Among the changes to farming practices that the Minister expects to see as a result of ELMs, he gave as examples livestock farmers being paid to put clover into their grass mix, which can absorb nitrogen and reduce the amount of fertiliser required, and to allow their hedgerows to grow to promote biodiversity.[408] On whether the Government should designate food as a public good, the Minister said "we take that for granted", as food production is the "primary purpose" of UK agriculture.[409]

Conclusions and recommendations on building food system resilience

197. **To achieve the diversity needed for a resilient food system, the UK must produce food through a variety of different farming methods spanning a spectrum from a return to more traditional methods, to agroecology, to the latest in cutting edge technology. We welcome the Government's commitment to identifying research priorities for innovation in food production, and its consultations on precision breeding and methane suppressing feed products.** ***We recommend that within the next***

402 Defra, ELM Policy Discussion Document, February 2020
403 National Farmers' Union (ECFS0020)
404 Q292
405 "Applications start for Sustainable Farming Incentive 2023", Defra, Rural Payments Agency and the Rt Hon Thérèse Coffey MP, 18 September 2023
406 HC Deb, 23 November 2023, UIN 2142 [Commons written answer]
407 "Right combinations of SFI actions could mitigate BPS loss, AHDB says", FarmingUK, 14 November 2023
408 Q294
409 Q295

six months the Government publish its priorities for agricultural innovation research and development—referring to our list of suggested topics—and ensure that these areas are backed by appropriate funding. This will provide clarity for researchers, industry, and investors.

198. **Urban horticulture and controlled environment agriculture both offer opportunities to improve the UK's self-sufficiency in fruit and vegetables. While they will not supplant the need for open-field farming, they can play a role in diversifying the UK's food sources and therefore building resilience.**

199. **As well as having environmental benefits, urban horticulture offers potential health and wellbeing benefits and employment opportunities in local communities.** ***The Government should take steps to encourage the availability of green and grey space for urban horticulture, particularly in deprived communities, and to upskill communities in growing knowledge, beginning with the school curriculum.***

200. **Controlled environment agriculture has the potential to provide a fresh year-round supply of foods that are usually imported and to minimise the environmental impact of the production of such foods, so long as it can use renewable energy wherever possible. We welcome the Government's plans to review the planning permission process to support new developments of vertical farms, but are disappointed that the Government's decision not to bring forward a horticulture strategy means that there will be no strategy for controlled environment horticulture.** ***The Government should explore ways to grow the controlled environment agriculture sector in an environmentally responsible way, such as through its Land Use Framework and its Environmental Land Management schemes, as well as through the business rates regime.***

201. **The Environmental Land Management schemes offer an opportunity that must not be missed to achieve the three pillars of adapting our food system to environmental change, mitigating the environmental harms caused by our food system, and slowing climate change and biodiversity decline in general. We do not think the Government should take for granted that food security is a public good, particularly given that farmers have encountered more extreme weather and rising costs since ELMs were first initiated. Any decline in food security has profound implications across society.** ***The Government should designate food security as a public good and incorporate food security and environmental goals more explicitly in the design of the Environmental Land Management schemes.***

202. **The initial reaction from the latest iteration of the Sustainable Farming Incentive appears to show that the Government has listened to farmers' concerns and made the offer more attractive.** ***However, to enable more effective scrutiny of whether that is the case, the Government should publish regular data on the uptake of all three Environmental Land Management schemes, with a long-term view towards publishing data on the environmental outcomes achieved by the schemes.***

203. **We recognise that changing UK food production practices and land uses will take time so that farmers and land owners can transition their businesses. Farmers need to be able to feed their families, but farming is about so much more than business:**

farming is also about culture, heritage, communities, and identity, and farmers need to be supported and listened to as UK farming transitions to a lower environmental impact.

204. **Farmers should have access to support from accredited advisers, to transition their businesses and adopt best practices to improve the resilience of our food system while adapting to and mitigating environmental change. This support should include knowledge and skills exchange between researchers, agri-tech developers, and farmers, to enable take up of technological innovations. Farmers should be able to access advice and practical support that is tailored to their local area. Existing networks such as the Linking Environment and Farming network, and the new Institute for Agriculture and Horticulture and What Works Centre, have potential to deliver this support.** ***The Government must ensure that small farmers have access to advisory services that are free to use. It should monitor take up of advice services by farms of all sizes.***

205. **New technologies can help to reduce the climate impacts of food production, prevent waste, and grow certain foods domestically for which the UK over-relies on imports. We agree with the Government that this is an exciting area. However, it is vital that emissions associated with these new technologies do not outweigh the environmental cost of importing the same product.** ***The Government should publish a strategy for technological innovation in food production, which should set out robust plans for trialling new technologies, understanding their net emissions, establishing an appropriate regulatory environment, and making technology accessible to farmers, in particular to small farmers.***

206. **For farmers to transition their businesses, their options need to be commercially viable.** ***The Government should expand its existing support mechanisms to incentivise take-up of technological innovations in food production, such as for precision irrigation and remote sensing. It should also develop natural capital options through its Green Finance Strategy. Any new incentives should be co-designed with farmers. All technological innovations that have been subsidised by the Government should be monitored closely to understand their impact and to prevent efficiency paradoxes arising.***

Conclusions and recommendations

Understanding our food system and developing a policy framework

1. Food self-sufficiency is an important aspect of food security. When developing relevant strategies, the Government must recognise the risks of national over-reliance on imports for many products, as experience earlier this year of empty shelves for certain salad items has taught. (Paragraph 44)

2. The UK food system is inseparable from the global food system, and increasing food security is not only a question of improving domestic self-sufficiency. To rely only on domestic production would increase the UK's vulnerability to extreme weather events in the UK. Even food produced at home depends on importing certain components from abroad, such as animal feed, fertilisers, and pesticide. (Paragraph 45)

3. Since food security depends on some degree of imports, it is vital that environmental harms are not exported abroad. That is why it is so important to get the UK's trade deals right on food and the environment. We welcome the Minister's desire to demonstrate global leadership on food production and the environment. *The Government must show its leadership by upholding standards for the environmental impacts of food production in its trading relationships with other countries. It should publish a statement on climate and biodiversity standards for food production, equivalent to its promised statement on animal health. Its commitment to incorporate climate scenario analysis into trade models by 2025 should be matched by biodiversity scenario analysis.* (Paragraph 46)

4. The food system globally and in the UK has become too concentrated and too driven by price alone. The Government and food industries must focus on embedding more diversity of produce and farming methods within the food system and reducing concentration in the market. (Paragraph 47)

5. *Given the increasing volatility in food supplies, not just due to extreme weather, but also due to the recent geopolitical and health crises we have experienced, the Government should publish its food security report annually rather than every three years as it has currently committed to. The fact that many of the measures included in the food security report are already published annually only lends more support, in our view, to the argument that the food security report ought to be published every year.* (Paragraph 66)

6. Defra collaborates with other Government departments and with industry on food security issues, but this work is neither sufficiently co-ordinated nor long-term. *The Government should establish a cross-government, cross-sector food security body to bring together all the actors in the food system to examine and make policy recommendations on long-term food resilience and environmental issues. While much food policy is devolved, some areas that affect food security, such as trade, are not devolved; and many farms straddle territorial borders. Therefore the cross-government body should also involve the devolved administrations. The body could be in the form of a Food Resilience Forum, but must take a long-term view. One*

responsibility with which this platform could be tasked would be to conduct forward-looking reviews in specific markets to inform investigations ahead of, rather than during, a crisis. (Paragraph 67)

7. The fact that the Government currently only has an "aspiration" for half of public money spent on food to be produced within the local area or produced to higher environmental standards is a missed opportunity. *The Government should turn its ambition on public procurement into setting a target, and should set mandatory environmental standards for publicly procured food.* (Paragraph 68)

8. Preventing and reducing waste at all stages in the food chain should be a central component of the Government's food strategy, as this is a quick-win compared to other actions to maintain food security in the face of environmental change. *The Government should publish a strategy for preventing and reducing waste in the food system. This should include targets and timescales, not just for reducing wastage of food itself but also for reducing the waste of resources that go into producing food, such as fertiliser and water.* (Paragraph 69)

9. We welcome the Government's ambitions to boost the UK seafood industry, a sector which is currently heavily reliant on imports. But significantly more detail is required on how it will do so in an environmentally sustainable way. *The Government must publish concrete proposals for improving the contribution of UK seafood to food security, setting out clearly how its proposals will improve rather than harm the natural environment.* (Paragraph 70)

Data and metrics

10. We welcome the Food Data Transparency Partnership and the progress it is making towards establishing baseline food sustainability metrics and methodologies. However, more clarity is needed on the areas in which the Government intends to set metrics and its timescales for doing so. Such metrics and tools are vital for knowing where action should be focused, and whether progress is being made to improve food resilience, soil health, carbon sequestration and nature restoration. A common standard for these measurements is also essential to maintain trust between policy-makers and the agriculture sector. (Paragraph 84)

11. *The Government should list all the areas in which it intends to establish baseline metrics and tools for food sustainability. These should include but may not be limited to: soil health, carbon sequestration, biodiversity net gain, and carbon credits. It should publish a timetable for when each metric will be in place.* (Paragraph 85)

12. *Only once national baseline metrics are in place, the Government should consult on mandatory carbon and biodiversity food reporting, as it is already doing for health metrics. The methodology for such reporting must account for the nutritional content of food.* (Paragraph 86)

13. *The Government should also consider compulsory reporting of waste by all food businesses as part of the waste prevention and reduction strategy that we recommend.* (Paragraph 87)

Soil and water

14. We welcome the targets that the Government has set to establish a soil health indicator; provide a methodology and tools for measuring soil health; publish a baseline map of soil health by 2028; and bring 60% of soils in England into sustainable management by 2030. *We recognise that measuring soil health is highly complex, and recommend that the Government explore a suite of indicators taking into account different biological, physical, and chemical factors among others. The Government must provide clear guidance for farmers with a realistic set of science-based benchmarks that they can use to measure the health of their soils accurately and affordably.* (Paragraph 94)

15. Water management on farms is going to become increasingly important as the climate changes. Using water more efficiently and storing it for use during droughts, as well as managing water demand overall, is going to be critical. (Paragraph 105)

16. *The Government must set stronger targets for reducing water demand. We support the Climate Change Committee's recommended target of no more than 100 litres of water per person per day.* (Paragraph 106)

17. A huge amount of water could be saved by more effectively facilitating the transportation of water from wetter to drier parts of the country. *The Government, in collaboration with the devolved administrations, should develop a policy mechanism to transport water more easily and quickly from places where water is plentiful to more water-stressed places.* (Paragraph 107)

18. Technologies that pinpoint the use of water offer much promise to irrigate farms in a more efficient in targeted way, and should be used more widely. While the Water Management Grant can be used to pay for water efficiency projects, this funding will benefit only a very small proportion of farmers in England. *The Government must develop a specific policy mechanism to promote and roll out precision irrigation across the UK farming system. In designing and monitoring the uptake of this mechanism, the Government should mitigate against efficiency paradoxes and report on the impact on water usage.* (Paragraph 108)

19. We welcome the Government's goal to increase water storage in the agriculture and horticulture sectors by two-thirds by 2050. We also welcome the Government's work on reviewing abstraction licenses and its call for evidence on the planning barriers to small reservoirs. However, food producers clearly feel that the Government is not doing enough nor moving fast enough. *To reach its target of increasing water storage by two thirds by 2050, the Government needs an implementation plan that considers and removes barriers in a holistic way, namely: funding, planning, and abstraction.* (Paragraph 109)

20. Poor quality water for farmers affects our food security, and so steps must be taken to reduce the water pollution that the agriculture industry itself causes. *We reiterate our recommendations on water pollution caused by agriculture, from our report on Water Quality, that the Government should:*

    - *Commission a five-yearly appraisal of catchment-wide nutrient flows;*

- *Establish a presumption against granting planning permission for new intensive livestock units where the proposed development would exceed the catchment's nutrient budget, unless there are more robust mitigations in place;*
- *Intensify work to inspect and remediate large animal slurry stores;*
- *Independently evaluate the risks to human health and the environment of spreading sewage sludge, and*
- *Assess and mitigate the risk of microplastic pollution from sewage sludge.*

We ask that in its response to this report, the Government includes an update on the commitments it provided in response to those recommendations. (Paragraph 112)

21. Currently, nutrients are being lost through leaching into waterways when they could be used to help grow crops. *The Government should develop, in collaboration with the devolved administrations and the food and farming supply chains, effective means to transport by-products such as nitrates and phosphates to parts of the UK where they are needed for farming. The Government should monitor the impact of these means on water quality.* (Paragraph 113)

Land use

22. The Government's commitment to publishing a Land Use Framework for England offers a vital opportunity to ensure that English land performs the many functions required of it, including food production, while also supporting the Government's net zero and nature targets. There is a clear consensus among stakeholders, other select committees, and the Government itself, with which we agree, that the framework should provide a non-prescriptive set of principles for decision-making, and that the three compartments underpinning the framework should be continuous rather than discrete categories. (Paragraph 141)

23. *The Minister committed to a publication timetable for the Land Use Framework of this year. We expect the framework to be published no later than the last sitting day in December of 2023 and we expect the framework to balance competing demands on UK land and to integrate fully food security as a central principle. The framework must set out how land will produce food in a way that supports the resilience of our food system while adapting to and mitigating climate change and biodiversity loss. Where feasible, land should be shared to help meet multiple objectives including food production, carbon sequestration, restoring nature, and growing energy crops. The framework must show evidence of having been co-produced with those who are affected by it. Finally, it must also evidence how productivity within existing uses can be improved without negative environmental impacts.* (Paragraph 142)

24. The success of the Government's forthcoming Land Use Framework is dependent on its harmony with the English planning system. *The Government should publish guidance, under the National Planning Policy Framework, to encourage planning authorities to manage applications for land use changes which affect food security on an expedited basis.* (Paragraph 143)

25. The questions of whether less meat and dairy should be produced in this country, and whether Britons should eat less meat and dairy, are emotive and personal. They cut to the core of our cultures and our identities and have the potential to be polarising. We heard a range of strong opinions. Many argued that people living in the UK should aim to cut down the amount of meat and dairy they consume, and the Climate Change Committee is clear in its advice that across the country meat and dairy consumption should reduce by 20% by 2030 and by 35% by 2050 in order to achieve the Government's net zero target. Others, however, pointed to the ecological benefits of grazing livestock. We are keenly aware that many people's livelihoods in this country depend on livestock farming. That is why *we also recommend supporting those farmers who wish to transition to new business practices where necessary and ensuring that their options for producing food in an environmentally sustainable way are commercially viable and culturally considerate.* (Paragraph 144)

26. *In its Land Use Framework, the Government, informed by the evidence we have received for our inquiry, should set out whether the UK can continue production at current levels, or should seek to increase domestic food production to enhance food security, while also meeting its targets on net zero and biodiversity. To do so it should publish alongside the Land Use Framework its methodologies for calculating how these potentially conflicting objectives will be met.* (Paragraph 145)

27. The Government does not want to tell people what to eat, but from its plans to encourage people to eat more healthily it clearly understands its role in helping people make better choices. In any case, if the Government will not tell people what to eat, the advertising industry will: we heard that for every £5 spent on public health education, £200 is spent on junk food ads. We welcome the Government's plans in its food strategy to encourage more sustainable eating, but there is more that it can do without being prescriptive. *In addition to our recommendations on public procurement, we recommend that the Government should publish national guidance on sustainable diets within the next twelve months. The Government's plans for a strong food curriculum in schools should include science-based education about the environmental impacts of food production, including food waste. The Government's work on UK consumer seafood habits should explore how to encourage consumers to eat a wider variety of more sustainable species.* (Paragraph 146)

Building food system reliance

28. To achieve the diversity needed for a resilient food system, the UK must produce food through a variety of different farming methods spanning a spectrum from a return to more traditional methods, to agroecology, to the latest in cutting edge technology. We welcome the Government's commitment to identifying research priorities for innovation in food production, and its consultations on precision breeding and methane suppressing feed products. *We recommend that within the next six months the Government publish its priorities for agricultural innovation research and development—referring to our list of suggested topics—and ensure that these areas are backed by appropriate funding. This will provide clarity for researchers, industry, and investors.* (Paragraph 197)

29. Urban horticulture and controlled environment agriculture both offer opportunities to improve the UK's self-sufficiency in fruit and vegetables. While they will not supplant the need for open-field farming, they can play a role in diversifying the UK's food sources and therefore building resilience. (Paragraph 198)

30. As well as having environmental benefits, urban horticulture offers potential health and wellbeing benefits and employment opportunities in local communities. *The Government should take steps to encourage the availability of green and grey space for urban horticulture, particularly in deprived communities, and to upskill communities in growing knowledge, beginning with the school curriculum.* (Paragraph 199)

31. Controlled environment agriculture has the potential to provide a fresh year-round supply of foods that are usually imported and to minimise the environmental impact of the production of such foods, so long as it can use renewable energy wherever possible. We welcome the Government's plans to review the planning permission process to support new developments of vertical farms, but are disappointed that the Government's decision not to bring forward a horticulture strategy means that there will be no strategy for controlled environment horticulture. *The Government should explore ways to grow the controlled environment agriculture sector in an environmentally responsible way, such as through its Land Use Framework and its Environmental Land Management schemes, as well as through the business rates regime.* (Paragraph 200)

32. The Environmental Land Management schemes offer an opportunity that must not be missed to achieve the three pillars of adapting our food system to environmental change, mitigating the environmental harms caused by our food system, and slowing climate change and biodiversity decline in general. We do not think the Government should take for granted that food security is a public good, particularly given that farmers have encountered more extreme weather and rising costs since ELMs were first initiated. Any decline in food security has profound implications across society. *The Government should designate food security as a public good and incorporate food security and environmental goals more explicitly in the design of the Environmental Land Management schemes.* (Paragraph 201)

33. The initial reaction from the latest iteration of the Sustainable Farming Incentive appears to show that the Government has listened to farmers' concerns and made the offer more attractive. *However, to enable more effective scrutiny of whether that is the case, the Government should publish regular data on the uptake of all three Environmental Land Management schemes, with a long-term view towards publishing data on the environmental outcomes achieved by the schemes.* (Paragraph 202)

34. We recognise that changing UK food production practices and land uses will take time so that farmers and land owners can transition their businesses. Farmers need to be able to feed their families, but farming is about so much more than business: farming is also about culture, heritage, communities, and identity, and farmers need to be supported and listened to as UK farming transitions to a lower environmental impact. (Paragraph 203)

35. Farmers should have access to support from accredited advisers, to transition their businesses and adopt best practices to improve the resilience of our food system

while adapting to and mitigating environmental change. This support should include knowledge and skills exchange between researchers, agri-tech developers, and farmers, to enable take up of technological innovations. Farmers should be able to access advice and practical support that is tailored to their local area. Existing networks such as the Linking Environment and Farming network, and the new Institute for Agriculture and Horticulture and What Works Centre, have potential to deliver this support. *The Government must ensure that small farmers have access to advisory services that are free to use. It should monitor take up of advice services by farms of all sizes.* (Paragraph 204)

36. New technologies can help to reduce the climate impacts of food production, prevent waste, and grow certain foods domestically for which the UK over-relies on imports. We agree with the Government that this is an exciting area. However, it is vital that emissions associated with these new technologies do not outweigh the environmental cost of importing the same product. *The Government should publish a strategy for technological innovation in food production, which should set out robust plans for trialling new technologies, understanding their net emissions, establishing an appropriate regulatory environment, and making technology accessible to farmers, in particular to small farmers.* (Paragraph 205)

37. For farmers to transition their businesses, their options need to be commercially viable. *The Government should expand its existing support mechanisms to incentivise take-up of technological innovations in food production, such as for precision irrigation and remote sensing. It should also develop natural capital options through its Green Finance Strategy. Any new incentives should be co-designed with farmers. All technological innovations that have been subsidised by the Government should be monitored closely to understand their impact and to prevent efficiency paradoxes arising.* (Paragraph 206)

Annex 1: List of suggested areas for research and development

One of the terms of reference of our inquiry was:

- Is there research and development the Government could be funding to provide food security solutions?

We received so many suggestions that we have listed them in this Annex, by theme, to help focus the mind of researchers, industry, and the Government.[410]

Nature-friendly farming

- Agroecology, including improving yields within agroecological systems
- Agroforestry
- Regenerative farming

Farming practices

- Dry farming
- Closed loop agriculture
- Urban horticulture
- Hydroponics
- The use of digestates in growing food in hydroponic systems

Understanding the effects of climate change and biodiversity loss on food security

- Risk of biodiversity loss on food production
- Weather and food chain data
- Scenario modelling of the impact of extreme weather on food supply

410 Jake Tadhunter (ECFS0001); Community Planning Alliance (ECFS0006); University of Essex (ECFS0009); Transforming UK Food Systems Programme (ECFS0013); Landworkers' Alliance - Farmers Union (ECFS0017); National Farmers' Union (ECFS0020); Nature Friendly Farming Network (ECFS0024); UCL Institute for Sustainable Resources, UCL Centre for Biodiversity and Environment Research (ECFS0029); Institute for Public Policy Research (IPPR) (ECFS0031); James Hutton Institute (ECFS0033); Anaerobic Digestion and Bioresources Association (ADBA) (ECFS0038); McCain Foods (GB) Ltd (ECFS0039); The Met Office (ECFS0040); The Country Land and Business Association (ECFS0042); Good Food Institute Europe (ECFS0049); Professor Neil Ward (Professor, School of Environmental Sciences at University of East Anglia); Professor Tim Benton (Research Director, Environment and Society at Chatham House); Professor Sarah Bridle (Professor of Food, Climate and Society at University of York); Professor Stefan Kepinski (Head of the School of Biology at University of Leeds); Dr Angelina Sanderson Bellamy (Associate Professor of Food Systems at University of West of England) (ECFS0050); Solar Energy UK (ECFS0051); Norwich Research Park (ECFS0053); Grantham Research Institute on Climate Change and the Environment (ECFS0054); Green Alliance (ECFS0056); CropLife UK (ECFS0059); Food Ethics Council (ECFS0062); The Food Foundation (ECFS0067); Dr Jill Edmondson (Senior Lecturer, School of Biosciences at The University of Sheffield) (ECFS0072); Q33 [Baroness Brown]; Q219 [George Monbiot]

Land use

- Land use optimisation
- Multifunctional land use such as combining renewable energy and crop production

Technology

- On-farm trials for new technologies
- Crop protection technologies
- Cradle-to-grave emissions of new technologies
- Alternative proteins

Climate change adaptation

- Climate-resilient breeds
- Assessment of food system adaptation actions
- Higher-yielding domestic pulse varieties

Climate change mitigation

- Promotion of plant-based diets
- Methane-suppressing feed additives
- Ammonia mitigation

The UK food system

- Resilience of the UK food system to shocks and disturbances
- Local food distribution and processing systems
- Climate impacts of processing, packaging, transport, storage, wholesale, retail, disposing and reusing

The global food system

- Trade deals and the balance between food supply and sustainability
- Environmental impacts of UK diets on international trade partners

Social factors

- The role of cultural practices and social status on food security
- The impact of individual choices and socio-economics on land use

- Food decision-making by disadvantaged communities
- Social impacts and consequences of technological innovations for farmers and rural communities
- Transdisciplinary research on land use, social and natural capital, and behaviour
- Agri-food skills and workforce development
- The sustainability of diets across all socio-economic groups

Access to knowledge

- Farmer access to data
- Co-ordinating research across disciplines and between farms and frontline companies

Soil and water

- Soil health
- Soil carbon, biology, and mineral content
- Water use efficiency
- Impact of climate change on water availability on farms

Waste reduction

- Feeding waste to livestock safely
- Integrated pest management
- Using unpasteurised digestates in horticulture

Annex 2: Visits to Wakehurst and Wimpole Estate, 11 May and 13 July 2023

The Committee visited Kew's Wakehurst Place in Sussex, on 11 May 2023, and the National Trust's Wimpole Estate in Cambridgeshire, on 13 July 2023, in connection with its inquiry. The Committee's principal interlocutors are set out below.

Thursday 11 May 2023

Wakehurst Place

- Ed Ikin, Director of Wakehurst
- Professor Phil Stevenson, Head of Trait Diversity and Function
- Dr Victor Deklerck, Research Team Leader, World Forest ID
- Dr Caspar Chater, Research Team Leader, Crops and Global Change
- Dr Elinor Breman, Senior Research Leader, Millennium Seedbank Partnership
- Dr John Dickie, Senior Research Leader, Seed Collections

Thursday 13 July 2023

Wimpole Hall

- Polly Ingham-Watts, General Manager, Wimpole Hall
- Lizzy Carlyle, Head of Environmental Practices, National Trust
- Katie Ramsey, Public Policy Officer, National Trust
- David Hassall, Farm and Countryside Manager, Wimpole Hall

Formal minutes

Wednesday 29 November 2023

Members present

Philip Dunne, in the Chair

Sir Christopher Chope

Ian Levy

Clive Lewis

Caroline Lucas

Cherilyn Mackrory

Jerome Mayhew

Dr Matthew Offord

Cat Smith

Claudia Webbe

Environmental change and food security

The Committee deliberated.

Draft report (Environmental change and food security), proposed by the Chair, brought up and read.

Paragraphs 1 to 45 read and agreed to.

Paragraph 46 read.

Amendment proposed, in line 7, to leave out "The Government must show its leadership by upholding standards for the environmental impacts of food production in its trading relationships with other countries".—(*Sir Christopher Chope.*)

Question put, That the Amendment be made.

The Committee divided:

Ayes, 4	Noes, 5
Sir Christopher Chope	Clive Lewis
Ian Levy	Caroline Lucas
Cherilyn Mackrory	Jerome Mayhew
Dr Matthew Offord	Cat Smith
	Claudia Webbe

Question negatived.

Paragraph 46 agreed to.

Paragraphs 47 to 206 agreed to.

Summary agreed to.

Annexes agreed to.

Resolved, That the Report be the Second Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available (Standing Order No. 134).

Adjournment

Adjourned till Monday 11 December at 4.30pm.

Witnesses

The following witnesses gave evidence. Transcripts can be viewed on the inquiry publications page of the Committee's website.

Wednesday 25 January 2023

Baroness Brown of Cambridge [Professor Dame Julia King], Chair, Adaptation Committee, Climate Change Committee; **Richard Millar**, Head of Adaptation, Climate Change Committee — Q1–30

Wednesday 22 March 2023

Professor Tim Lang, Emeritus Professor of Food Policy, City University London's Centre for Food Policy; **Dr Elizabeth Boakes**, Research Fellow, Centre for Biodiversity and Environment Research, University College London; **Dr Monica Zurek**, Senior Researcher, Environmental Change Institute, University of Oxford — Q31–62

Balwinder Dhoot, Director of Sustainability, Food and Drink Federation; **James Young**, VP Agriculture, McCains; **Guy Singh-Watson**, Founder, Riverford Organics — Q63–113

Wednesday 19 April 2023

Henry Dimbleby, Co-founder, Leon Restaurants, Lead, Independent review of the food system for the Government: The National Food Strategy — Q114–146

Minette Batters, President, National Farmers' Union (NFU); **Sue Pritchard**, Chief Executive, The Food, Farming and Countryside Commission; **Chris Brown**, Senior Director for Sustainable Supply Chains, Asda; **Peter Dawson**, Policy and Sustainability Director, Dairy UK — Q147–184

Wednesday 7 June 2023

George Monbiot, author of Regenesis: Feeding the World Without Devouring the Planet; **Professor James Lowenberg-DeBoer**, Elizabeth Creak Chair of Agri-Tech Economics, Harper Adams University — Q185–258

Dr Jill Edmondson, Senior Lecturer, School of Biosciences, University of Sheffield; **Judicaelle Hammond**, Director of Policy and Advice, Country Land and Business Association; **Edwin Morgan**, Director of Communications, Harvest London — Q185–223

Wednesday 12 July 2023

Rt Hon Mark Spencer MP, Minister of State (Minister for Food, Farming and Fisheries), Department for Environment, Food and Rural Affairs; **Tessa Jones**, Agri-Food Chain Director, Department for Environment, Food and Rural Affairs — Q224–316

Published written evidence

The following written evidence was received and can be viewed on the inquiry publications page of the Committee's website.

ECFS numbers are generated by the evidence processing system and so may not be complete.

1 Anaerobic Digestion and Bioresources Association (ADBA) (ECFS0038)

2 Blue Marine Foundation (ECFS0007)

3 British Sugar (ECFS0026)

4 Burrington, T (ECFS0052)

5 CCm Technologies (ECFS0002)

6 CPRE the countryside charity (ECFS0063)

7 Community Planning Alliance (ECFS0006)

8 CropLife UK (ECFS0059)

9 Dairy UK (ECFS0014)

10 Defra (ECFS0022)

11 Eating Better (ECFS0069)

12 Edmondson, Dr Jill (Senior Lecturer, School of Biosciences, The University of Sheffield) (ECFS0072)

13 Feedback (ECFS0035)

14 Floodplain Meadows Partnership (ECFS0046)

15 Food Ethics Council (ECFS0062)

16 Game & Wildlife Conservation Trust (ECFS0055)

17 Global Sustainability Institute (ECFS0004)

18 Good Food Institute Europe (ECFS0049)

19 Grantham Research Institute on Climate Change and the Environment (ECFS0054)

20 Green Alliance (ECFS0056)

21 Harvest London (ECFS0073)

22 Heyburn, Mr James (Policy and Engagement Officer, Imperial Policy Forum); Mijic, Dr Ana (Director, Centre for Systems Engineering and Innovation, Imperial College London); Paschalis, Dr Athanasios (Senior Lecturer in Hydrology, Department of Civil and Environmental Engineering, Imperial College London); and Fonseca, Ms Elizabeth (Research Postgraduate, Centre for Environmental Policy, Imperial College London) (ECFS0012)

23 Institute for Public Policy Research (IPPR) (ECFS0031)

24 James Hutton Institute (ECFS0033)

25 Jeremy Coller Foundation (ECFS0023)

26 Landworkers' Alliance - Farmers Union (ECFS0017)

27 Lowenberg-DeBoer, Professor James (Elizabeth Creak Chair of Agri-Tech Economics, Harper Adams University) (ECFS0074)

28 MSD Animal Health (ECFS0058)

29 McCain Foods (GB) Ltd (ECFS0039)

30 Monbiot, George (Journalist and Author, n/a) (ECFS0070)

31 National Farmers Union Scotland (ECFS0010)

32 National Farmers' Union (ECFS0020)

33 National Sheep Association (ECFS0011)

34 Nature Friendly Farming Network (ECFS0024)

35 Norwich Research Park (ECFS0053)

36 Public Policy Projects (ECFS0061)

37 Regather (ECFS0015)

38 Say No to Sunnica Action Group Ltd (ECFS0034)

39 Soil Association (ECFS0041)

40 Solar Energy UK (ECFS0051)

41 Spicer, Mrs Allyson (ECFS0008)

42 Spicer, Mrs Allyson (ECFS0019)

43 Sturdy, Mrs Emma (Farmers Wife, JO & RW Sturdy) (ECFS0016)

44 Sustain: the alliance for better food and farming (ECFS0047)

45 Sustainable Food Places; and Sustain (ECFS0027)

46 Tadhunter, Jake (ECFS0001)

47 Thames Crossing Action Group (ECFS0068)

48 The Country Land and Business Association (ECFS0042)

49 The Food Foundation (ECFS0067)

50 The Food, Farming and Countryside Commission (ECFS0071)

51 The Met Office (ECFS0040)

52 The National Federation of Fishermen's Organisations (ECFS0043)

53 The Sainsbury Laboratory; and John Innes Centre (ECFS0066)

54 Transforming UK Food Systems Programme (ECFS0013)

55 UCL Institute for Sustainable Resources; and UCL Centre for Biodiversity and Environment Research (ECFS0029)

56 University of Essex (ECFS0009)

57 WWF-UK (ECFS0065)

58 Ward, Professor Neil (Professor, School of Environmental Sciences, University of East Anglia); Benton, Professor Tim (Research Director, Environment and Society, Chatham House); Bridle, Professor Sarah (Professor of Food, Climate and Society, University of York); Kepinski, Professor Stefan (Head of the School of Biology, University of Leeds); and Bellamy, Dr Angelina Sanderson (Associate Professor of Food Systems, University of West of England) (ECFS0050)

59 Wildlife & Countryside Link; and RSPB; National Trust; The Wildlife Trusts; Bumblebee Conservation Trust; Rare Breeds Survival Trust; The Rivers Trust; ZSL; People's Trust for Endangered Species (ECFS0018)

List of Reports from the Committee during the current Parliament

All publications from the Committee are available on the publications page of the Committee's website.

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Number	Title	Reference
1st	The financial sector and the UK's net zero transition	HC 277

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1st	Building to net zero: costing carbon in construction	HC 103
2nd	Pre-appointment hearing: Chair of the Environment Agency (Pre-appointment hearing)	HC 546
3rd	Recommendations on the Government's draft environmental principles policy statement	HC 380
4th	Accelerating the transition from fossil fuels and securing energy supplies	HC 109
5th	Seeing the wood for the trees: the contribution of the forestry and timber sectors to biodiversity and net zero goals	HC 637
6th	The UK and the Arctic Environment	HC 1141
1st Special Report	Water quality in rivers: Government Response to the Committee's Fourth Report of Session 2021–22	HC 164
2nd Special Report	Greening imports: a UK carbon border approach: Government Response to the Committee's Fifth Report of Session 2021–22	HC 371
3rd Special Report	Building to net zero: costing carbon in construction: Government Response to the Committee's First Report	HC 643
4th Special Report	Accelerating the transition from fossil fuels and securing energy supplies: Government and Regulator Response to the Committee's Fourth Report	HC 1221

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1st	Biodiversity in the UK: bloom or bust?	HC 136
2nd	The UK's footprint on global biodiversity	HC 674
3rd	Green Jobs	HC 75

Number	Title	Reference
4th	Water quality in rivers	HC 74
5th	Greening imports: a UK carbon border approach	HC 737
1st Special Report	Energy efficiency of existing homes: Government Response to the Committee's Fourth Report of Session 2019–21	HC 135
2nd Special Report	Growing back better: putting nature and net zero at the heart of the economic recovery: Government and Bank of England Responses to the Committee's Third Report of Session 2019–21	HC 327
3rd Special Report	Biodiversity in the UK: bloom or bust?: Government Response to the Committee's First Report	HC 727
4th Special Report	Green Jobs: Government Response to the Committee's Third Report	HC 1010
5th Special Report	The UK's footprint on global biodiversity: Government Response to the Committee's Second Report	HC 1060

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1st	Electronic Waste and the Circular Economy	HC 220
2nd	Pre-appointment hearing for the Chair-Designate of the Office for Environmental Protection (OEP)	HC 1042
3rd	Growing back better: putting nature and net zero at the heart of the economic recovery	HC 347
4th	Energy Efficiency of Existing Homes	HC 346
1st Special Report	Invasive species: Government Response to the Committee's First report of Session 2019	HC 332
2nd Special Report	Our Planet, Our Health: Government Response to the Committee's Twenty-First Report of Session 2017–19	HC 467
3rd Special Report	Electronic Waste and the Circular Economy: Government Response to the Committee's First Report	HC 1268