

State of the Art Review

Food, farming and land use in a net zero UK

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NICRE SOTA Review No 3: December 2021 (updated, November 2023)

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Non-technical abstract

The transition to net zero greenhouse gas emissions by 2050 is an international commitment now enshrined in UK law which will drive innovation across the economy. The transition will bring both opportunities and challenges for rural and land-based organisations. For the agri-food system, the transition is likely to involve an expansion of land under energy crops and woodland, lower-emission farming practices and reductions in consumption of higher-emission foods such as meat and dairy products. However, there are contrasting views on the balance between these measures. Currently, the land use sectors lag behind other economic sectors in responding to the net zero challenge, but the next five years will be critical in developing new, low-emission pathways and infrastructure to transition to a net zero state. These will require innovation on a scale not seen since the post-war transformation of the British countryside.

Summary

The transition to a net zero UK by 2050 will stimulate innovation among businesses and other organisations in rural areas. In the UK, reducing emissions has been guided by the carbon budgets produced by the Government's statutory advisor, Climate Change Committee. Its Sixth Carbon Budget (2021) sets out planned reductions in emissions from more climate-sensitive farming practices, an expansion in energy crops and woodland and forestry and dietary change. A tension between 'land-sharing' and 'land-sparing' approaches to greening farming and land management is emerging and climate and biodiversity objectives do not wholly align. Nevertheless, a revolution in rural land use will be required over the next three decades, and much can be learned from the support frameworks for innovation during the UK's 20th century technological revolution in farming and land use. The key challenges will be: i) developing a mix of regulation, financial incentives, knowledge exchange and monitoring systems that help the transition to lower-emission land management practices; ii) developing physical and financial infrastructure to develop successful supply chains for bioenergy and carbon capture and storage; and iii) promoting a shift towards healthier diets and less wasteful and carbon-intensive food consumption practices among the population.

Background

In June 2019, the UK became the first major economy to legislate to achieve net zero emissions by 2050. Reducing emissions has stimulated structural change in electricity generation and rapid change is underway in transportation, but the agri-food system is a difficult and lagging emissions source. In 2020, the Government's statutory advisor, the Climate Change Committee (CCC), proposed that changing farming practices would have to deliver the same amount of food on less farmland in ways that significantly reduce greenhouse gas emissions, especially from livestock systems and fertilizer practices. The area of woodland would have to increase by an extra 30,000 hectares every year during the 2020s, rising to 40,000 hectares a year in the 2030s. At least 23,000 additional

hectares of energy crops would need to be grown each year, and half of upland and a quarter of lowland peat would need to be restored. Finally, a 35 per cent reduction in meat and dairy consumption and a 20 per cent reduction in food waste by 2050 would help reduce demand. Other organisations present alternative pathways. On one hand, the National Farmer's Union's plans avoid any need for reduced consumption of red meat and dairy, or any reduction in livestock numbers (NFU, 2019). On the other, the Food, Farming and Countryside Commission proposed deeper dietary changes, the cessation of all pesticides and the introduction of an agroecological approach (Poux *et al.*, 2021). Post-Brexit policies for agriculture and land management are in development but there are calls for payment systems to prioritise emissions reduction above all else and for a new national land use strategy to balance food production, climate change, biodiversity and flood management objectives. At the same time, technological changes such as the development of alternative sources of proteins and bioenergy and carbon capture are likely to alter the context within which rural businesses must negotiate the transition to a net zero world.

Evidence

The net zero target is focussing minds on the timescales and pattern of greenhouse gas reduction across the economy. The Sixth Carbon Budget requires a 63 per cent reduction in emissions from 2019 to 2035 on the pathway to net zero by 2050, but progress in agriculture and land use has been below target for some years now and the UK Government has faced increasing criticism from the CCC.

Emissions reducing farming practices fall into two types. Nature-based (or 'land-sharing') solutions, such as regenerative agriculture and agroforestry, seek to build a stronger cyclical economy and ecology around farming by making better use of natural processes and improving soil carbon sequestration, and planting larger and more extensive hedgerows and crops intermixed with farmland trees. Other approaches (sustainable intensification or 'land-sparing') seek to improve resource efficiency through improved animal and plant breeding and health, improved application of inputs, and the use of big data and robotics. This 'frees up' more land for sequestration and biodiversity objectives. Defra surveys suggest almost a third of farmers place little or no importance on greenhouse gas emissions when making decisions about their farming (Defra, 2020), so there remains a challenge around education, peer-to-peer learning, and incentivisation. There is also a need for improved emissions accounting to support land managers and other businesses in reducing emissions.

In land use, bioenergy crops can produce electricity with carbon captured and stored underground, potentially in former North Sea oil and gas wells. 'Bioenergy carbon capture and storage' (BECCS) could potentially contribute to net emissions reductions by capturing carbon from the atmosphere. BECCS could provide new markets for biomass products, including waste products such as straw or forestry thinnings, although a national infrastructure for the processing, energy generation and carbon capture and storage will be required. BECCS is expected to develop during the 2020s and make a significant contribution to reducing net emissions by the 2030s.

In dietary change, scientific opinion suggests that healthier diets can help ensure the world's population is fed within safe environmental operating limits (EAT-Lancet, 2019). This requires a significant reduction in meat, dairy and more processed foods. Land that is currently used to grow feed for ruminant livestock could then be more efficiently used (in terms of calories produced per hectare). In the UK, if emissions reductions fail to meet targets in other sectors then more could be asked of dietary change, but even a 50 per cent reduction in meat and dairy would still leave the average British diet beyond recommended healthy levels. The innovation challenge is in developing healthy and environmentally beneficial food products that are attractive to consumers. And policy makers require more sophisticated models of behaviour change among consumers but also among food businesses and regulatory bodies. The new National Food Strategy (2020; 2021) and corresponding White Paper response (Defra, 2022) provide useful and timely analysis of the UK's food and diet challenges.

Final overview

In summary, the implications of the net zero challenge for food, farming and rural land use are only beginning to be recognised, but there is an urgency to innovate to deliver sufficient reductions to meet the UK's international obligations. Significant structural and technical change in agriculture and rural land use in the UK was delivered between the 1930s and 1970s and the net zero challenge of the 2020s to 2040s will require a concerted effort of similar scale and ambition. Innovation will be required ranging from carbon accounting management information systems for small and land-based businesses in the rural economy on the one hand, to large-scale infrastructure to deliver bioenergy power generation with carbon capture and storage on the other. Although there are signs of a greater consumer willingness to make dietary changes in response to climate change, we have yet to see ground-breaking new healthy, nutritious and low-emission food products that are sufficiently attractive to consumers, leaving dietary change as perhaps the most difficult challenge. There will be an important role for social and institutional innovation too, with experimental and participatory approaches to help effect change, although the urgency of timescales is of the essence.

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Neil Ward is a co-lead of UKRI's AFN Network+ (AgriFood4NetZero). Further details of its activities, including webinars and podcasts, can be found at: <https://www.agrifood4netzero.net/>

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