Achieving NET ZERO

Farming's 2040 goal

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Introduction

The NFU has set the ambitious goal of reaching net zero greenhouse gas (GHG) emissions across the whole of agriculture in England and Wales by 2040. This is our contribution to the UK's ambition of net zero by 2050.

Agriculture is uniquely placed to be part of the solution, as both an emissions source and a sink. As farmers we have a special responsibility to protect carbon reserves already in our soils and vegetation. But we must and we can do more. We know emissions from UK farms presently amount to 45.6 million tonnes of carbon dioxide (CO_2) equivalent a year – about one-tenth of UK GHG emissions. But in stark contrast to the rest of the economy only 10 per cent of this is CO_2. Around 40% is nitrous dioxide (N_2O) and 50% is methane (CH_4).

The NFU's assessment is that we can only deliver net zero if we act across a range of internationally recognised inventories. Based upon the latest scientific evidence, our approach has been discussed with the Committee on Climate Change, so we believe our aim is challenging, but attainable, given the right incentives.

There is no single answer to this problem. To achieve our aim we will need a range of measures that fall under three broad headings:

- Improving farming's productive efficiency;
- Improving land management and changing land use to capture more carbon;
- Boosting renewable energy and the wider bioeconomy.

At the same time as reducing our impact on the climate, we should not reduce our capacity to feed UK consumers with high quality, affordable British food. The UK must not achieve its climate change ambitions by exporting UK production, or our greenhouse gas emissions, to other countries.

Our ambition for a net zero contribution to climate change across the whole of agricultural production by 2040 is a national aspiration, not an expectation that every farm can reach net zero. Every farm will start the journey to net zero from a different place and will need a unique action plan.

It is important to start that journey by assessing the likely emissions sources on farm. I know the future on my farm has to be about holistic farm management - not organic versus conventional, but sustainable farming practice that focuses on building soil health. Our mixed rotation is focused on continually striving to improve grazing pasture, introduce more clover and herbal leys which help to fix nitrogen so we use less fertiliser, and GPS technology is supporting our ability to precision farm. I'm confident that new feed additives and minerals will also help further reduce methane and regular benchmarking ensures I'm getting the best performance and productivity out of my livestock. Focusing on health status and the right genetics are key to carbon neutral farming.

The NFU believes that the agricultural sector is very much part of the solution to decarbonising the UK economy and achieving net zero and we are working on proposals for pilot schemes to introduce policy incentives to bring to life net zero for farmers and growers. But we will only be able to achieve our carbon neutral goal with concerted support from government, industry and other key groups to help deliver this challenging, but achievable, ambition.

Minette Batters
NFU President

The global challenge of tackling climate change

Climate change is arguably the greatest environmental challenge facing the world, with many countries now experiencing unprecedented and increasingly frequent extremes of weather. International action on this issue has been slow to take off, but progress is now being made in decarbonising the global economy as well as in adapting to a changing climate.

Britain's Climate Change Act of 2008 introduced the world's first long-term national framework to tackle climate change, setting a legally binding target of an 80% reduction in GHG emissions by 2050, against a 1990 baseline. After a few false starts, the comprehensive international Paris Agreement on climate change was approved in 2015, aiming to limit GHG emissions "as soon as possible" and keeping global temperature increase "well below" 2C. The Paris Agreement also recognised the importance of "safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the adverse impacts of climate change".

Three years later, the Intergovernmental Panel on Climate Change issued a scientific report on the potential impacts of global warming and how the rise in global temperature should be limited to 1.5C. It concluded that the risks and impacts of 2C average warming compared with 1.5C justify a much deeper and faster policy response, in terms of technological changes to energy and food production as well as human lifestyle.

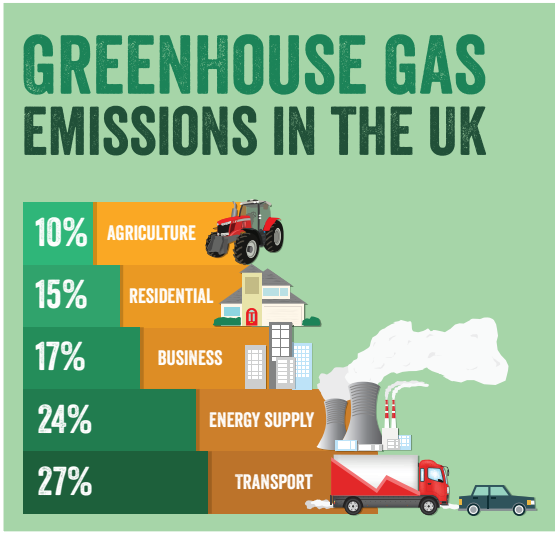
In 2019, Britain became the first major world economy to legislate for net zero emissions, aiming to end the contribution of UK economic production activities to climate change over the next 30 years. Many other countries and trading blocs are expected to follow suit, raising hopes that the worst effects of climate change can be avoided in the near future.

The current UK agricultural GHG inventory

Agricultural GHG emissions are very different from other sectors of the economy, such as electricity generation, transport and manufacturing. The principal GHG emitted by most industries is carbon dioxide (CO_2) from fossil fuel combustion, while for agricultural systems methane (CH_4) and nitrous oxide (N_2O) are the main GHGs. Reducing these emissions is more difficult than cutting CO_2, because they result from complex and imperfectly understood natural soil and animal microbial processes, a changing climate and the limitations of measurement.

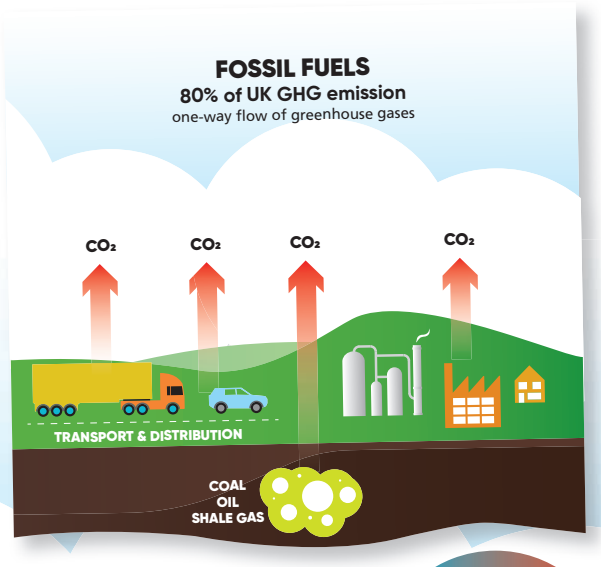
A supply of nitrogen from organic or inorganic sources is necessary for the growth of crops and pasture, and it is an unavoidable consequence of soil processes that a small amount of nitrogen in an agricultural system will be emitted as nitrous oxide. Likewise, methane is produced by bacteria as cattle and sheep break down the cellulose in their diet, producing milk and meat for human consumption from large areas of grassland that would be unsuitable for arable farming.

British agricultural GHG emissions in 2017 were 45.6 million tonnes of CO_2 equivalent (10% of UK total GHG emissions), comprising methane (5.6% of UK total), nitrous oxide (3.1%) and CO_2 (1.2%). Agricultural emissions have decreased by 16% overall since 1990, but there has been only modest progress since 2011, when the industry's GHG Action Plan was agreed.



Why agriculture is part of the solution to climate change

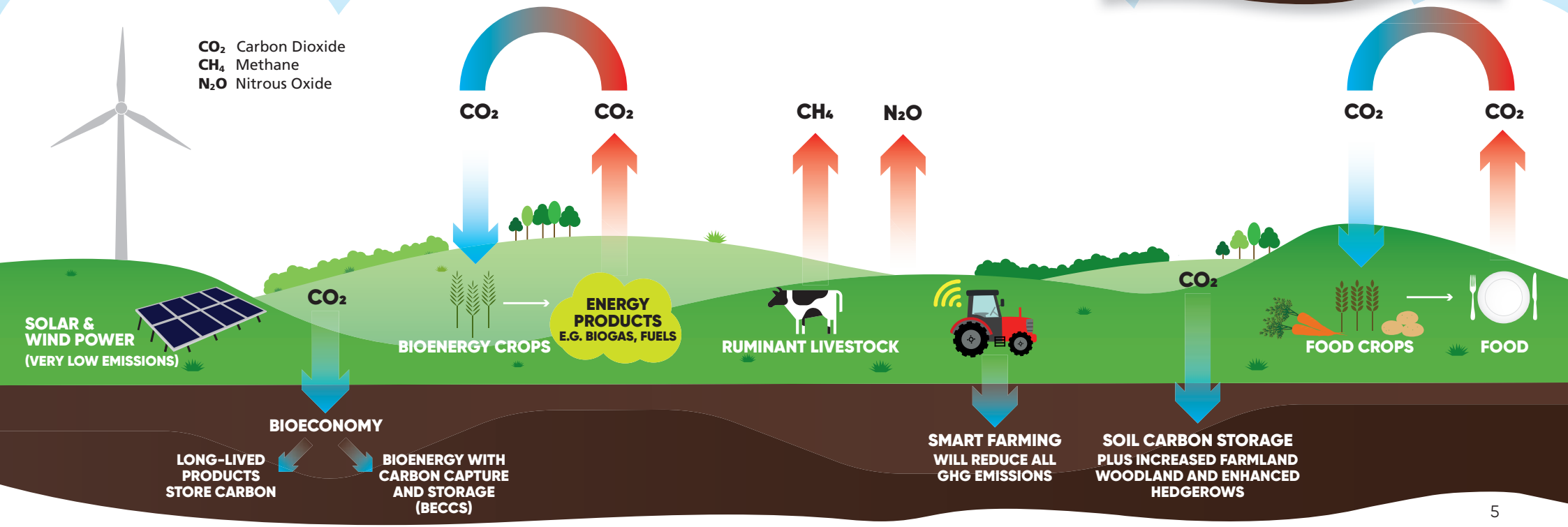
Agriculture, and the land-based economy, can play a key role in tackling climate change. It is uniquely placed to capture the major greenhouse gas – carbon dioxide (CO_2) – from the air and turn it, with the help of farmers, into a wide range of foods, fibres and fuels. By enhancing this ability to capture carbon we can use it to generate "negative emissions" – actively removing CO_2 from the atmosphere and balancing agriculture's emissions of methane (CH_4) and nitrous oxide (N_2O) from food production.



AGRICULTURE

10% of UK GHG emissions

circular, balanced flows of greenhouse gases



The NFU's vision: our approach

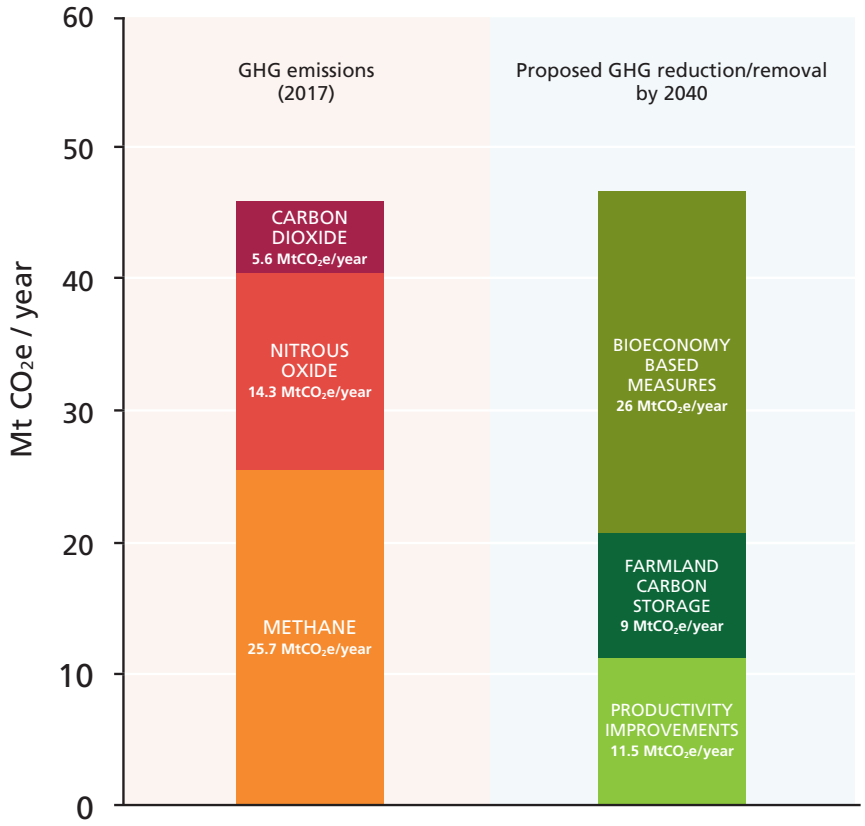
Now is the right time to set ourselves challenging goals, consistent with our high standards of production, welfare and environmental stewardship, as farmers and growers adjust to a new domestic agricultural policy. There are clear environmental and economic imperatives for action. As an industry we must respond to growing scientific evidence of the impacts of climate change, and the experience of our farmers and growers weathering extremes of cold, drought and flood in recent years.

Farm businesses can make an important contribution to building a zero-carbon economy for Britain and the NFU recognises that we must set out how this can be best achieved alongside the many other expectations on farmers and growers.

There are no 'silver bullet' answers to tackling climate change and achieving net zero. We believe action to tackle climate change in UK agriculture requires a portfolio of different policies and practices focused on three key themes, or pillars:

- Improving farming's productive efficiency to reduce our greenhouse gas emissions – enabling farming to produce the same quantity of food, or more, with less inputs in smarter ways;
- Farmland carbon storage in soils and vegetation – improving land management and changing land use to capture more carbon, through bigger hedgerows, more woodland, and especially more carbon-rich soil;
- Boosting renewable energy and the bioeconomy to displace greenhouse gas emissions from fossil fuels and to create GHG removal through photosynthesis and carbon capture.

Our evidence suggests that, over the next 20 years, work under these three pillars could reduce, offset and counterbalance current agricultural emissions of 45.6 $MtCO_2e$/year.

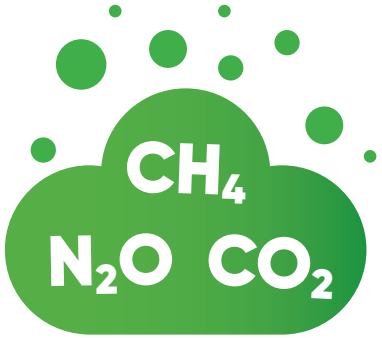


Current (2017) agricultural emissions balanced against potential GHG reduction through productivity measures and GHG removals by various methods

Pillar 1

Boosting productivity and reducing emissions

Estimated GHG savings: **11.5 $MtCO_2e$/year**



Productive efficiency measures could deliver estimated GHG savings of **11.5 $MtCO_2e$/year**

Improving farming's productive efficiency will enable farmers to produce the same quantity of food, or more, with less inputs, in smarter ways. This, in turn, will enable the sector to reduce its greenhouse gas emissions.

A variety of measures to boost productivity and reduce emissions, as identified by the Committee on Climate Change (CCC), plus others emerging from current NFU work on productivity will be required to achieve this. These measures include things like:

- The use of controlled release fertilisers and inhibitors to increase efficient use of nitrogen and reduce emissions;
- Feed additives to reduce methane emissions from ruminant livestock;
- Improving health in cattle and sheep to reduce methane emissions and boost growth rates;
- Precision farming for crops to deliver nutrients and crop protection more efficiently;
- Loosening compacted soils and preventing soil compaction in cropland and pasture, reducing the need for cultivation and minimising N_2O emissions;
- Anaerobic digestion to convert animal manures, crops and crop by-products into renewable energy;
- A wide range of energy efficiency measures to reduce usage of fuels and electricity;
- Gene editing for disease resistance to improve health and productivity of crops and livestock and reduce emissions.

To enable us to achieve these improvements in farming's productive efficiency, we need:

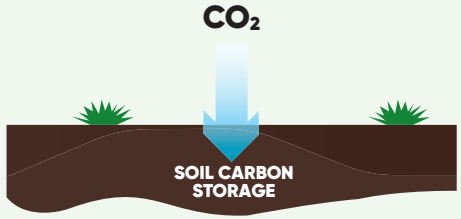
- Defra to immediately introduce pilot productivity schemes alongside the Environmental Land Management Scheme (ELMS);
- Shared Prosperity Fund support for rural development;
- Department for Business, Energy and Industrial Strategy (BEIS) support through the Industrial Strategy.

Pillar 2
Farmland carbon storage

Estimated GHG savings: **9 $MtCO_2e$/year**

Farming is already responsible for a critical carbon resource in soils, wooded landscape and semi-natural habitats. The achievement of net zero should actively incentivise the conservation of this carbon resource as well as its enhancement. This conservation and enhancement can be achieved through improving land management and changing land use to capture more carbon – by the provision of bigger hedgerows, more woodland and especially more carbon-rich soils.

- Enhanced soil carbon storage could deliver GHG savings of 5 $MtCO_2e$/year. This would require Defra support for a network of demonstration farms and the development of a mechanism for reward payments.
- Enhancing and increasing hedgerows could deliver GHG savings of up to 0.5 $MtCO_2e$/year. This would require the inclusion of hedgerow management in the Environmental Land Management Scheme (ELMS); the promotion of hedgerow options in Championing the Farmed Environment (CFE); and support from Defra and Treasury for carbon pricing.
- Increasing woodland planting on farms could deliver GHG savings of 0.7 $MtCO_2e$/year. Inclusion of woodland and shelter belt planting in ELMS; promotion of new planting in CFE; and support from Defra and the Treasury for carbon pricing will be needed to help achieve this.
- Peatland and wetland restoration might deliver GHG savings of up to 3 $MtCO_2e$/year. Support for this work in ELMS will be needed to help achieve this.



Enhanced soil carbon storage
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Enhancing and increasing hedgerows
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Increasing farmland woodland
could deliver GHG savings of
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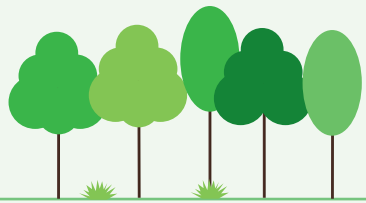
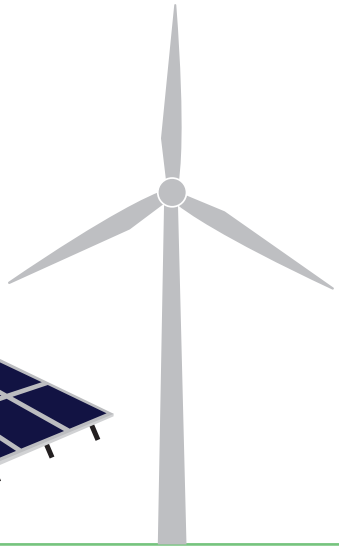


Pillar 3

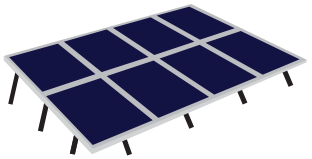
Coupling bioenergy to carbon capture, utilisation and storage

Estimated GHG savings: **Up to 26 $MtCO_2e$/year**

Photo courtesy of FUTURE BIOGASS LIMITED



Boosting renewable energy and the bioeconomy could deliver estimated GHG savings of up to **26 $MtCO_2e$/year**



Boosting renewable energy and the bioeconomy to displace greenhouse gas emissions from fossil fuels and to create GHG removal through photosynthesis and carbon capture is a key part of the NFU ambition for achieving net zero.

- Bioenergy with carbon capture and storage (BECCS) – the process of producing energy from organic matter and capturing and storing the carbon produced – could deliver GHG savings of up to 22 $MtCO_2e$/year. Implementation of the industry-led Bioenergy Strategy by BEIS, a clear carbon price trajectory and multiple demonstration projects at different scales will be needed to achieve this.
- Bio-based materials in construction and industry could deliver GHG savings of 0.5 $MtCO_2e$/year. This will also require the implementation of the Government's Bioeconomy Strategy, as well as support from the Home Office and Ministry of Housing, Communities and Local Government for novel building and insulation materials like hemp fibre and sheep's wool.
- Displacement of fossil fuel use by land-based renewables could deliver GHG savings of up to 3 $MtCO_2e$/year. This will need the government to enable further growth in land-based renewables and BEIS and Defra to allow credit for avoided GHG emissions.

In the longer term, it is possible that the application of biochar – powdered charcoal – to soil and accelerated mineral weathering could deliver GHG savings of up to 2.5 $MtCO_2e$/year and up to 1 $MtCO_2e$/year, respectively. These processes will require further evaluation and approval before use.

Partnership working – with government, with industry, with academics

The policy measures needed to enable UK farming to meet our net zero aspiration will require a partnership approach. Uptake by farm businesses will need to be accompanied by concerted support across government departments, agencies and other stakeholders to act with us and help us deliver on this ambition.

For example, boosting productivity across all farm sectors needs a range of policy measures not just from Defra but also BEIS, the Treasury and other government departments to enable investment in new technology and refurbishment of existing capital, consistent with the Industrial Strategy and Clean Growth Strategy.

Enhancing carbon storage in soils and vegetation will require collaborative working with environmental NGOs. There also needs to be recognition by both these NGOs and government of the multiple environmental benefits that could be layered together with carbon storage in response to a realistic carbon reward price.

The UK also needs to develop a strong domestic bioenergy base in the short term, alongside other land-based renewables, in order to build up its longer-term potential for greenhouse gas removal in the future, through a variety of bioenergy pathways as well as the wider bioeconomy.

By working together as an industry, across all farming sectors, choosing from a broad range of policy measures will enable individual farm businesses to take action on net zero.

Measurement, reporting and next steps

Systems for farmers and growers to track and be rewarded for the public good of reducing or offsetting GHG emissions have yet to be developed. These may need to be based upon both physical audits (actually measuring and recording changes in farm practice) as well as expected results predicted by modelling. It is quite likely that monitoring and verification of certain measures, such as enlarged or extended hedgerows, will be easier than others, such as soil carbon.

However, "proxy indicators" of changed management practice which are likely to increase carbon storage could be coupled to models that are supported by actual field testing, carried out on a network of 'climate-friendly' demonstration farms, which would represent different farming systems across a range of soils and natural environments. Ideally a single integrated measure such as the Sustainability Metric that the Sustainable Farming Trust proposes, would capture a range of agronomic and environmental factors.

There is an urgent need now to pilot our ambitions with support from government and other stakeholders, bringing net zero to life for the farmers and growers who are critical to its success. Our initial pilot proposals aim to develop a farmer-friendly framework for monitoring and reporting tools, to boost confidence that changes in on-farm practice are being captured. Such a framework might be validated and confirmed with reference to a field testing farm network, and backed up by actual physical measurement across a small sample of the total.

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