

Net zero: farming and the countryside

Farming accounts for [around 10%](#) of the UK's greenhouse gas emissions. This can be reduced through changes in technology, farming practices and dietary habits. Cutting food waste offers a highly economic option.

Farming and wider land use will be crucial in achieving a net zero economy. It will be almost impossible to get to net zero unless land use overall absorbs more greenhouse gases than it produces. 'Negative emissions' may offer new commercial opportunities to farmers and landowners.

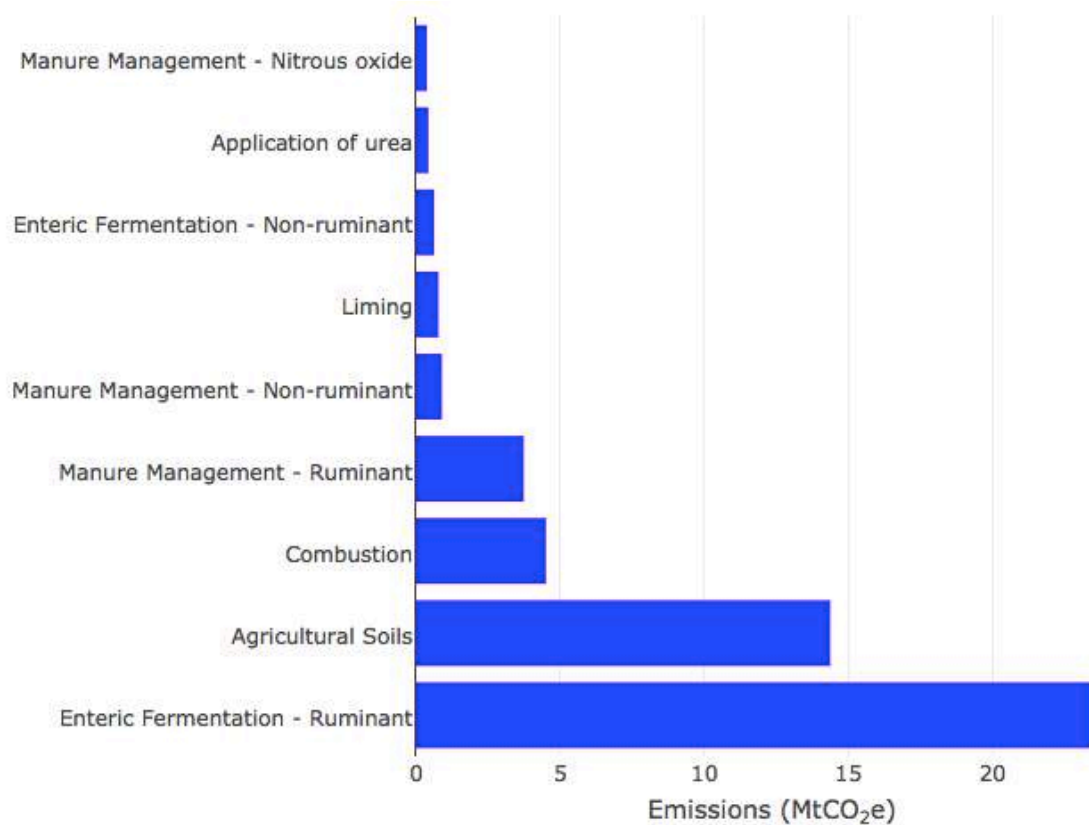
Agricultural sources of greenhouse gases

Farming produces significant amounts of the greenhouse gases carbon dioxide, nitrous oxide and methane. There has been no fall in UK agriculture emissions [over the past six years](#).

Carbon dioxide from the atmosphere is absorbed by growing plants, stored as organic matter in the soil and gradually released as it decays. It is also produced in the operation of farm machinery, and when adding lime to improve acidic soils.

Nitrous oxide is produced in soil from the breakdown of synthetic fertilisers and animal manure. Some methane also comes from manure, but the main source is 'enteric fermentation', the gas belched out by cattle and other ruminant animals as they digest grass. [Only about 10%](#) of the methane produced by livestock comes out of the other end.

Methane is UK agriculture's predominant greenhouse gas, making up about 56% of the total.



UK Agriculture emissions by source in 2015, BEIS

The most effective route to reducing the emissions from agriculture would be limiting the amount of methane they produce in converting grass into meat and dairy products.

Efficiency of production

Intensification of animal production is one possibility for improving this conversion efficiency. But while keeping cattle permanently indoors allows greater control over inputs such as food and veterinary medicines, and more effective recycling of waste products (methane and dung), there is resistance among [many consumers](#) to the idea that cattle should not have the opportunity to graze outdoors.

Meanwhile, science-based options for boosting production such as the growth hormone bovine somatotropin are banned in the EU on animal welfare grounds. Some other options are unproven in practical use, such as including [seaweed in cattle feed](#) which can block the chemical



In Britain, people prefer dairy cows to be able to graze outdoors. Image: AgriLife Today, creative commons licence

reaction in the cow's stomach which produces methane. Still more are at an early stage of development; for example, there are ongoing studies which aim to activate genes to boost the animals' resistance to disease or increase productivity. Genetic improvement through selective breeding is capable of improving the feed efficiency of cattle at a rate of [about 1% a year](#).

Reducing emissions from arable land and grassland

[About 84%](#) of the UK's nitrous oxide emissions come from soil, mainly due to the breakdown of fertilisers and animal manure used to increase crop and pasture productivity. Research is helping farmers to calculate more accurately the amount of nitrogen-based fertilisers needed, which in turn requires development of technologies to [automatically monitor the nitrogen content of soil](#). Other studies are looking at using biochar – charcoal particles produced from processed crop materials – to [increase the carbon dioxide-carrying capacity](#) of the soil.

Meanwhile, '[no-till agriculture](#)' involving the planting of seed without ploughing has attracted interest from arable farmers in some countries as a potential way to encourage sequestration of carbon dioxide through organic material in soil, while also preventing release of valuable nitrogen and phosphate resources.

Cutting food waste

Another simple method to reduce emissions would be to slash the volume of food wasted. Household food waste [costs £14.9 billion](#) a year in the UK. The food industry is supporting a voluntary initiative, the [Courtauld Challenge](#), aimed at cutting waste by 20% by 2025 (equivalent to a reduction from 165kg to 125kg of food per person). More efficient use of the food we produce could allow more land to be set aside for reforestation, conservation and leisure activities.

Changes in diet

Per-capita consumption of red meat is falling across the developed world, with more people eating lower-carbon white meat products such as chicken. In the UK, the amount of beef and lamb eaten per person has [fallen by more than 15%](#) over the past decade. However, the average Briton still eats about 60g of animal protein per day, more than twice the amount recommended by public health experts. Eating more fresh fruit and vegetables and reducing animal protein consumption closer to recommended levels could reduce the numbers of premature deaths in the UK each year by [an estimated 36,000](#).

Barriers to change

All governments have struggled to control greenhouse gas emissions in agriculture, due largely to the complex nature of the industry. Changes in, say, transport or energy policy will usually require action by a few large corporations. But food production is the work of thousands of individual farmers each with their own unique circumstances.

Food production is an increasingly international business. Britain imports roughly 50% of all the food it consumes including [around 45%](#) of its animal protein but also exports nearly a quarter of its meat and dairy produce. So national policies to encourage farmers to reduce emissions must take account of this trade, ensuring that the emissions problem is not simply exported.



New opportunities

Around 40% of farms produce some renewable energy, helping them to diversify their income. Further investment in anaerobic digestion could allow biomethane generated from farmyard waste to replace some fossil fuel gas. Bioenergy crops could be used to generate electricity as well as capturing atmospheric carbon, so generating 'negative emissions' (see our [Negative Emissions briefing](#)).

British farming encompasses thousands of individual farms, of differing size and circumstance. Image: Ian Britton, creative commons licence

There is potential growth in the forestry industry, with the government's climate change advisory committee proposing that 70,000 hectares of land (1 ha is roughly the size of a rugby pitch) be assigned to [afforestation projects in Britain by 2025](#).

Wood could become a [more widely used construction material](#) as it helps to lock up the carbon it contains for decades, again generating 'negative emissions'.

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