Sustainable Food Trust
A global voice for sustainable food and health

What role for livestock in climate-friendly farming?

Sustainable Food Trust briefing.

If we are to address the challenges of climate change, biodiversity decline and the crisis in public health, we must tackle the fundamental issues in our food and farming systems. The dominant industrial model of food production is hugely damaging to both people and planet. Yet farming, with grass-fed livestock as a key part of it, has the potential to be perhaps the biggest nature-based solution to climate change.

The debate about the role of livestock in climate-friendly farming systems has become too simplistic – reduced to 'animals versus plants'. Yet this fails to differentiate between livestock that are part of the problem, and those which are a key part of the solution. We need to look at the question of livestock from a **whole food system perspective**, considering the many social and environmental factors, and evaluating the impact of animal agriculture in its proper context.

Therefore, cutting all meat consumption is not the simple answer to saving the planet. Instead, we must look at the sustainability of **all** foods, both plant and animal-based, and make a more nuanced choice about what we should eat to be healthy and sustainable, on the basis of *how* these foods are produced. In other words, **'it's not the cow, it's the how, the where and the why'**. Crucially, we should align our diets as far as reasonably possible with what can be produced sustainably in the countries or regions in which we live. Re-localising our food systems is important for future resilience and reducing our climate impact.

Key Points Summary

1. Industrial livestock systems are absolutely part of the problem, contributing to climate change, biodiversity decline, poor animal welfare and human health issues.

2. But pasture-based livestock, such as cattle and sheep, can work in harmony with nature, helping restore soil health and biodiversity, whilst producing nutrient-dense food.
3. Assessing the carbon footprint of food based on global figures can be misleading because the footprint can vary drastically based on where and how it is produced.
4. Reducing UK beef production and meeting demand through imports from countries with higher emissions per kilo of meat than the UK could increase global emissions.
5. The current way the warming impact of methane emissions is measured (GWP100 equivalence metric) is flawed. So, while methane emissions from cattle and sheep are quite large (and account for 4-5% of UK GHG emissions) their actual impact on global warming is smaller than is generally understood. An improved method of measurement, called GWP* should instead be adopted.
6. Soils are the world's biggest terrestrial carbon store but intensive farming is causing them to be depleted. A return to mixed farming, with diverse grasses and livestock integrated with crop production and agroforestry, would rebuild natural soil fertility and store significant quantities of carbon.

What type of livestock systems?

Industrial livestock systems are absolutely part of the problem, contributing to climate change, biodiversity decline, poor animal welfare and human health issues. Systems that feed animals on crops that humans could otherwise eat, contribute to deforestation, soil degradation and add carbon to the atmosphere. Indoor-housed pigs and poultry, large-scale intensive dairy, as well as beef and sheep systems that rely on high use of concentrate feeds, substantial amounts of nitrogen fertiliser and antibiotics, plus those that degrade grasslands and biodiversity, are clearly all part of the problem. In countries like the United States, Concentrated Animal Feeding Operations (CAFOs), where thousands of animals are confined indoors or in feedlots and fed grain and soya, are particularly problematic.

But not all livestock systems are the same. Extensive, pasture-based livestock farming can **work in harmony with nature** and help restore soil health and biodiversity, whilst producing nutrient-dense food and sustainable fibres from land poorly suited to other crops. Integrated with arable crops and agroforestry, grazing livestock have a role in creating diverse mixed farming systems that will be more **resilient in the face of greater weather extremes caused by global warming, than current intensive production systems.**

Pasture-based livestock and mixed farming systems can provide a number of key benefits:

- Well-managed grazing is important for biodiversity, creating and maintaining important grassland habitats for birds and other wildlife. This is why grazing animals are often used by conservation organisations to manage reserves and other protected landscapes.
- Pasture-based systems can deliver high standards of animal welfare, as they are more closely aligned with the natural environment of the animals and enable them to behave more naturally.
- Chemical fertilisers, which contribute significantly to climate change, can be reduced or cut out completely because soil fertility is built using legumes that fix nitrogen naturally in the soil, and through the addition of manure from the animals themselves.
- Grazing animals efficiently convert otherwise-inedible plant material into nutrient-dense, human-edible food.
- Well managed diverse grazing systems and crop and animal rotations can prevent the build-up of weeds and parasites, reducing the need for chemical weed, pest and parasite control.
- Provide employment in environmentally-constrained areas where other opportunities are limited.
- Maintain many of the landscapes we love and that we identify as part of our cultural heritage.

For these reasons (and many others) we view this approach to livestock production as not just a 'better' way of producing meat, but of fundamental importance to sustainable food production.

Variations in the carbon footprint of meat

Assessing the sustainability of food based on its carbon footprint alone can be problematic, as it fails to account for the many other environmental, social and health impacts of production. In particular, using global carbon figures rather than country-specific data, is misleading because the footprint of meat produced in one part of the world can be very different to that of meat produced in another part of the world. In the UK, two-thirds of farmland is under grass, which grows particularly well in our temperate, high rainfall climate. This is one of the key reasons why the carbon footprint of British beef is only half the global average, and that of organic beef in the UK only about a third of the global average.

In contrast, the carbon footprint of Brazilian beef from former rainforest land is about 30 times higher than that average for beef produced in the UK. This is due to the destruction of rainforest and other virgin land associated with some of the production in Brazil, and the associated carbon losses, plus the fact that the productivity of Brazilian grass on former rain forest land is less than half the productivity of British grasslands.

Reducing UK beef production and meeting demand by increasing imports from countries with higher emissions per kilo of meat than the UK would increase global emissions. However, because greenhouse emissions are attributed to the country where food is produced, not the country where it is consumed, this increase in global emissions would paradoxically help the UK Government meet its zero carbon by 2050 target. This problem, referred to as 'carbon leakage', needs to be tackled through improved policy frameworks that prevent such counter-productive shifting of environmental burdens. Policy also needs to take into account emissions associated with shipping and international aviation.

What about methane?

It is absolutely correct that agriculture must tackle its greenhouse gas emissions and move towards net zero as rapidly as possible. However, a better understanding of the different emissions from agriculture, what causes them and how they impact climate change would enable us to prioritise action in the right places.

When it comes to methane, the current way that the Government measures the warming impact of methane emissions (the GWP100 equivalence metric) is flawed because it fails to take account of the persistence of each greenhouse gas. So, while methane emissions from the UK's cattle and sheep are high (and account for about 5% of UK greenhouse gas emissions) their actual impact on global warming is much smaller than is generally understood.

This measurement issue represents a major barrier to the development of well-informed policy both on agricultural greenhouse gas emissions in general, and on the role of livestock within sustainable food systems specifically.

GWP100 treats methane as a 'stock' greenhouse gas which accumulates in the atmosphere in the same way as long-lived gases like CO2 or nitrous oxide (N2O). However, methane is short-lived in the atmosphere – staying there for around 12 years – and is better understood as a 'flow' gas, whose impact on temperature depends largely on whether the rate of emissions is rising (leading to rapid warming), stable (leading to broadly stable temperatures) or falling (which causes a cooling effect).

After around 12 years, the levels of methane in the atmosphere produced by a constant population of cattle and sheep will level off. This is because the methane they continue to produce merely replaces the methane they emitted previously, which is now breaking down in the atmosphere. For as long as the number of cattle and sheep stay the same, their ongoing emissions only increase temperatures slightly. In contrast, new CO2 entering the atmosphere from the burning of fossil fuels increases warming considerably, as it adds to the total amount already there and stays there for thousands of years. Of course, if methane emissions are rising, due to increasing cattle numbers or losses from oil and gas extraction or coal mining, this will increase global warming, and for a time, by even more than is currently recognised.

To address this issue with the way that greenhouse gas emissions are calculated, an improvement to GWP100, called GWP*, has been developed. GWP* accounts for changes to the rate of emissions of greenhouse gases, and therefore reflects much more accurately the impact of methane on global temperature.

As a result, governments should use the GWP* metric when calculating CO2-equivalent emissions and treat methane differently to long-lived greenhouse gases. This would allow the impacts of actions to reduce agricultural greenhouse gas emissions to be assessed more accurately and underpin a better-informed climate policy.

There is a final part to the story. The methane in the atmosphere breaks down to CO2. However, the carbon contained in methane released by ruminants is only that taken in by the animals in plant matter – it is part of the natural cycle and so, when released, doesn't cause any net increase in atmospheric CO2 levels. In other words, it comes from the atmosphere and eventually it is returned to the atmosphere. Sustainable livestock systems can even reduce atmospheric CO2 through the sequestration of carbon in well-managed grassland soils (as discussed lower down).

In contrast, when methane from fossil fuel extraction breaks down, the CO2 that remains is an addition to the system. Methane losses during the extraction of fossil fuels cause almost exactly as much methane to be emitted to the atmosphere as is emitted by ruminants (see illustration), but also represent new carbon adding to that already in the atmosphere.

The pressure to reduce methane is partly because it is the only major short-lived GHG. This means that reducing methane emissions will have a rapid impact on global warming, due to its quick breakdown in the atmosphere. This fast change is seen as vital if we are to reduce emissions by 45% by 2050 to avoid breaching 1.5 degrees of warming, and underlies the new international commitment announced by President Biden to reduce methane emissions by 30% by 2030. However, the IPCC is clear that warming will continue after 2050 and that the main target has to remain avoiding breaching 2 degrees by the end of the century. From that longer perspective, CO2 emissions become much more significant than methane. Applying the quick fix of methane reduction cannot delay what is really needed – a reduction in emissions from fossil fuel extraction and use.

Action is of course still needed to reduce methane emissions from agriculture, but net zero warming from methane will be achieved by a 10% reduction by 2050. As such we should prioritise preventing losses of methane to the atmosphere from the oil, gas and coal industries, as the technologies already exist to do this. It is important that global ruminant numbers do not increase any further and that solutions such as breeding programmes to reduce methane from livestock are given support and time to develop. It has been estimated that these could cut methane from ruminants at a rate of 3% per year with an ultimate reduction of up to 50%.

What all of this makes clear, is that there will be space for well-managed extensive grazing systems within a Paris-compliant carbon budget.

Soil should be central to our climate strategy

Soils are the world's biggest terrestrial carbon store, containing more carbon than is found in the atmosphere and all of the world's vegetation combined. But ongoing mismanagement of our soils through intensive crop production with chemical fertilisers and pesticides is resulting in a disastrous loss of carbon into the atmosphere. Overgrazing is also a cause of soil degradation. However, in many cases the root cause is not the traditional small farmers, but land grabbing by other countries to supply affluent populations with cheap and out of season produce in countries thousands of miles away. This forces pastoralist onto the poorest land where the soils are thinnest and lack resilience.

By returning to regenerative mixed farming, with fertility-building grass and legumes integrated with crop rotations, we have the opportunity to improve soil health and store significant quantities of carbon. For this reason, **farming methods which improve soil health must become a central tenet of our climate response and carbon sequestration strategy.**

Permanent grassland has much higher soil carbon levels than arable land, due to the lack of soil disturbance and much greater level of carbon inputs delivered by the permanent sward and associated soil microbiota. This also applies (though to a lesser extent) to arable land where a significant percentage of the crop rotation consists of a

fertility-building temporary grass ley, which has been shown to result in significantly higher soil carbon levels than is found in continuously cultivated arable soils.

For these reasons, it is crucial to avoid ploughing up grasslands and converting them to continuous crop production, as this would release significant amounts of carbon. It also means we should incorporate temporary grass leys through a return to mixed farming systems across all of our arable areas in order to increase carbon levels in what are often dangerously degraded soils. This would also deliver a host of other benefits, such as improved water storage capacity which would help mitigate flooding and improve resilience to drought.

As with arable soils, when degraded grasslands are placed under better grazing and grassland management, soil carbon levels can increase significantly over the course of a few decades. Increased plant species diversity can also increase soil carbon levels under permanent grassland. This would also deliver a number of biodiversity benefits, and a significant reduction in the emission of nitrous oxide emissions where forage legumes like clover are included in order to avoid the use of nitrogen fertiliser.

There is also some evidence to suggest that permanent grasslands can increase their soil carbon levels when managed under a system of rotational grazing – i.e. where livestock are moved from area to area on a regular basis. More research is needed to understand this area.

Why we must wean ourselves off nitrogen

Our current food systems are suffering from an addiction to nitrogen. Global use of nitrogen fertiliser has grown exponentially, causing catastrophic damage to the environment and public health. Without serious corrective measures, nitrogen pollution could push the planet to breaking point. While agriculture is not the only contributor to nitrogen pollution (transport and energy generation also produce substantial amounts), it is the primary source and is responsible for approximately two-thirds of reactive nitrogen emissions.

Over the last century, artificial nitrogen fertiliser has provided a straightforward and cost-effective method for farmers to boost productivity, fuelling agricultural

intensification and the expansion of food production worldwide. As a result of these gains, governments have turned a blind eye to the significant negative impacts of the use of nitrogen fertiliser, choosing instead to prioritise the short-term goal of increasing the production of commodity crops. However, it is becoming more and more obvious that we can no longer overlook the damage that our addiction is causing, particularly in connection to:

- Soil degradation resulting from exploitative crop rotations that rely on nitrogen fertilisers;
- Rising air pollution from ammonia and the associated formation of secondary particulate matter;
- Pollution of the atmosphere from greenhouse gases and ozone depletion;
- Loss of habitats and delicate plant species smothered by plants that thrive in high nitrogen environments;
- Dramatic declines in farmland birds, small mammals, pollinating insects, invertebrates;
- Eutrophication and acidification of rivers, lakes and marine coastal regions;
- Elevated nitrate levels in drinking water;
- Loss of marine and aquatic species due to dead-zones caused by run-off.

Along with reducing artificial fertiliser, we also need to move away from intensive livestock systems which themselves contribute significantly to nitrogen pollution, and ensure pasture-based livestock adopt good management practices when it comes to manure.

However, pasture and grazing livestock have a key positive role to play. The use of forage legumes in rotation increases the soil's natural nitrogen levels and helps to reduce the use of artificial fertilisers, significantly lessening the amount of reactive nitrogen in the atmosphere. Grazing livestock are used not only to derive food from these otherwise inedible forage legumes, but because they themselves improve soil health through the grazing and trampling of vegetation and via the manure they produce.

Biodiversity

Unlike other parts of the world such as the tropics, much of the land in Europe has a long history of human interference which has replaced the natural disturbances, such as megaherbivores and wildfires, necessary to support biodiversity in these regions. Appropriately managed grazing by livestock can therefore fulfil this missing role. Appropriate grazing is fundamental to the support of many native UK habitats, including grassland, heathland and coastal marshes, which are inhabited by culturally valued species of birds, small mammals and insects, many of which benefit or even rely upon the presence of agricultural activity.

Grazing livestock can selectively consume dominating plants such as grasses, scrub and tree saplings which, if left uncontrolled, would proliferate and prevent the growth of valuable but less competitive species. Cattle are particularly important in this respect, as they do not graze too closely to the ground or target flower heads which allows a diverse range of plant species to continue to set seed. Cattle are also able to trample very rough areas of vegetation, further preventing the over-domination of scrub. This is a basic tenet of conservation ecology, hence the presence of grazing livestock on most UK nature reserves. Mixed rotational grazing, relatively low stocking densities and grazing at appropriate times of year are generally key to achieving this positive role, though each habitat and site will differ in its grazing prescriptions and some areas benefit from no or very limited.

Re-introducing grazing livestock into arable areas is also hugely important if we are to transition to cropping rotations that support soil ecosystems which are both fertile and resilient to pests and diseases, reducing reliance upon chemical inputs. Grazing livestock can thereby deliver indirect benefits to biodiversity too, by preventing the non-target effects of pesticides on pollinators and other farmland species, and by reducing the need for chemical fertilisers, the application of which can have hugely detrimental impacts on the natural world.

The variety of rare and heritage livestock breeds in the UK and elsewhere in the world also represent an important yet often forgotten element of biodiversity which must be preserved. These breeds tend to be found more on small-scale pasture-based livestock

farms than on large intensive ones, which tend to favour a single type of highly productive breed such as Holstein cattle.

Trees in livestock systems

Trees can be grown hand in hand with grazing livestock – both through the use of hedgerows with field margin trees, and through the introduction of agroforestry systems, where trees and agricultural production are incorporated on the same area of land. Doing so can deliver a whole host of social, agricultural and environmental benefits, including significant carbon sequestration potential. There is even some research indicating that silvopasture (the integration of trees and livestock) can sequester more carbon than equivalent but separate areas of woodland and pasture.

However, this is not the model of woodland expansion or livestock production receiving most support at present. The dominant narrative, perhaps best exemplified by the Climate Change Committee's approach, is for the afforestation of large areas of UK grassland, and the further intensification of many of the grasslands that remain. This would bring significant risks to UK biodiversity. Instead, we must ensure that afforestation is achieved in a way that delivers increases in woodland biodiversity without reducing farmland biodiversity. This could be achieved through agroforestry, small scale farm woodlands, as well as more extensive afforestation only where this would be actively beneficial to the environment and wouldn't result in the enforced displacement of farmers.

Health and nutrition

When comparing foods in terms of their climate impacts, the key question of nutritional value is often overlooked. However, taking this into account can have a very significant bearing on how we understand the environmental footprints of different foods and production systems. For instance, work by the Rothamsted Institute shows that beef (and to a lesser extent lamb) have a similar carbon footprint to pork and chicken when nutrient content replaces weight of product as the unit of measurement. This is because red meat is a very dense source of high-quality protein and a range of other important nutrients, including some (such as vitamin B12 and iron) which are generally more difficult to obtain from plant foods. There is also a growing body of research showing

that meat and dairy produced from pasture-based systems have a better nutritional profile (for instance, a more desirable balance of omega-3: omega-6 fatty acids) than when animals are fed significant quantities of grain.

Meat and dairy produced from sustainably managed, grass-based systems can therefore be an invaluable source of nutrition. At a global level, research indicates that somewhere between 9-23 grams of protein per person per day (around 20-50% of the world's total requirements) could be provided by livestock reared on human inedible feeds (with the most important of these being grass), as well as 10% of our energy and iron needs, 20% of our calcium and zinc needs, and a massive 75% of our vitamin B12 needs. This is a crucial food source if we are to feed a growing population.

What should we eat?

Overall meat consumption needs to be reduced. But we must differentiate between which types of meat are damaging for the planet and which actually contribute to sustainable farming systems.

We should therefore significantly reduce consumption of intensively produced pork and poultry, plus imported or largely grain-fed beef or lamb.

However, locally reared, mostly pasture-based meat and dairy have a place in sustainable, climate friendly farming systems and in a healthy diet.

Most importantly though, the sustainability of *all* foods should be considered – not just meat. Many plant-derived foods have a significant negative impact through being grown with chemicals, transported from far away countries or through requiring a lot of water or non-renewable resources such as fossil fuels in order to produce them. Intensive production of crops can cause grave destruction to soils, waterways and wildlife habitats, as well as emitting huge amounts of carbon. When choosing what to eat, it is important to consider where and how it has been grown. Buying locally, seasonally or direct from producers is often a good way to ensure you know the true story of the food you are eating.

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We are working to empower citizens to make the right food choices. A Global Farm Metric would mean food and farming sustainability is more accurately measured and understood. Methods of production labelling would then help citizens to understand more about the food they are buying.

Join us in our mission to bring about sustainable food and farming systems that are good for people and the planet. Follow us on social media, sign up to our newsletter or make a donation to support our work.
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