SMALL WORLD CONSULTING

UK Farming and Land Use: Addressing the Climate and Ecological Emergencies while Supporting Farmers

Executive Summary

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The new paper by Small World Consulting seeks to bring the latest scientific evidence to the contentious and emotive debate around what truly sustainable farming and land use in the UK should look like.

Farmers are being asked to deliver greater food production, restore nature, capture carbon and provide sustainable livelihoods for rural communities. And to do this while facing the ever-increasing impacts of climate change, which afflict the land as droughts, floods and heatwaves. Farmers and other stakeholders are saying the current situation isn't environmentally or economically sustainable, but there are many questions and conflicting answers about what is.

Should we cut livestock numbers, or could regenerative farming capture carbon in the soil to counteract the methane from ruminant animals? If a farm has arable monitoring drones, low-carbon energy and specially bred cattle fed with seaweed, how low can its emissions get? Do we need to eat less meat and dairy? If so, how can this be achieved, and if we do, will we lose vital biodiversity that depends on grazing? What are the impacts of arable farming? Do we need more indoor, vertical farms, or do they use too much energy and water compared to fields? How can farmers and their communities be enabled to thrive better than ever while whatever changes we need are implemented?

Many people will find these questions interesting and important, but they're questions that policy makers in particular need to address seriously to achieve clarity about the future of UK land use and farming, and to put in place practical measures to support a genuinely just transition in farming. The answers need to draw on a wide body of peer-reviewed scientific research, and on insights from farmers who have in-depth knowledge of the practical constraints and opportunities on their land.

In developing this paper, Small World Consulting has used recent peer-reviewed scientific research including our own, government and industry reports, and other relevant sources. The paper is also informed by conversations we have had with multiple stakeholders including individual farmers, the NFU and other industrial bodies, local and national government officials, civil servants, scientists, consultants, citizen assemblies, and media. The paper also includes insights from the work Small World Consulting has undertaken for multiple clients over a number of years, including all UK National Parks, several National Landscapes, Local Authority districts, counties and private estates, as well as food manufacturers and supermarkets.

The importance and complexity of the debate around UK food and farming demands a commitment from all parties to honour the best available evidence, and to respect the legitimate interests of all parties in a proportionate way. In writing this paper, we strived to adhere to these principles ourselves, and we remain open to evolving our views on various issues discussed here if and when further evidence emerges.

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Each of the 15 questions addressed in the paper sets out the context, an answer and the scientific evidence that supports it, as well as the key counterarguments used in the debate. Each answer is nuanced but there are some general conclusions that can be drawn from them collectively:

- When deciding how to optimise the use of each piece of land, we need to consider the impacts on climate, nature, food production and livelihoods – locally, across the UK and globally.
- There is a role for livestock in regenerative farming, although in lower numbers than current stocking levels.
- Regenerative farming does improve biodiversity, soil health and carbon storage. Reducing livestock numbers would allow more land for crop production and some land to be restored as woodlands, peatlands and wetlands, which would be even more effective for biodiversity and carbon storage.
- New technologies relating to livestock, including methane-reducing breeds and diets, should be pursued but not relied upon as a sole solution. We need to deploy all the available options to reduce emissions.
- While there is a role for regenerative livestock farming, the need to reduce meat and dairy consumption is also clear-cut; this will both reduce agricultural emissions and free up land for other uses, both in the UK and worldwide, by reducing the imported feed crops fed to UK livestock.
- A more plant-based food system would allow the UK to reduce imports and increase food security. New technologies for producing plant-based foods indoors, including vertical farms, may also allow non-rural areas to contribute to UK food production.
- Farmers' current practices and cultural identities are already being threatened by the effects of climate change as floods, heatwaves and droughts alter our landscapes.
- Farmers will need support across policy and society so that they can lead the rest of society to a sustainable food and farming system, and safeguard their communities and livelihoods against the impacts of climate change.
- Farmers need to be central participants in the debate on sustainable farming, and a clear scientific evidence base will aid them as well as all other parties involved.

Below are summaries of the key points in each answer. We recommend reading the full answers in the main paper ("SWC Farming and Land Use - Full Paper") for further details and evidence sources.

1. How should the debate on the future of UK farming be conducted?

The future of the UK's food and land system is important, complex and demands the highest-quality decision-making and cooperation across many stakeholders.

There are understandable emotions felt by many where livelihoods, communities and traditions are felt to be at stake or under pressure to change. There is confusion over the emerging and complex nature of scientific evidence, which we've tried to address in the 14 questions below. There is also a threat of misinformation from some stakeholders with commercial vested interests – a threat which we should take seriously since it has plagued policymaking in other industries, such as tobacco and fossil fuels. And alongside many thoughtful and well-informed

actors across the debate, there have also been some examples of entrenched polarisation and even misrepresentation of evidence.

To create an environment which is conducive to high-quality decision-making, we propose the following five principles. We hope these can be signed up to by all those engaging in discussion and policymaking on the future of sustainable food and agriculture in the UK.

- **Principle 1: Honour the best evidence.** All parties agree to honour the highest-quality evidence, including the best available science.
- **Principle 2: Respect all interests.** All stakeholders should respect and take account of all interests in a proportionate way. In particular, the debate should positively engage with the farming community to seek their views and to ensure they are active participants in the discussion.
- **Principle 3: Transparency of motive and funding.** All those involved in the debate should undertake to be transparent about their direct and indirect financial interests, including how they may stand to be affected by different outcomes.
- **Principle 4: Foster open-mindedness**. In a high-quality debate, there is a great deal of development of thinking from everyone involved. Open-mindedness in the face of good evidence is to be applauded, as it enables better outcomes. If we can't yet see all the answers, we should trust in our collective problem-solving.
- **Principle 5: Uphold a culture of honest, evidence-based and respectful debate.** All parties agree to respectfully work to encourage and insist on these principles being upheld by others. We should especially support those who go out of their way to honour this principle, even when in doing so, they challenge their own community or our own actions.

2. How do we effectively support farmers through the transition to a more sustainable land use and food system?

Farmers have enabled us to live throughout the ages. Their population is ageing, but the expectations on farmers increase; they are now being asked not only to produce more food in a changing climate, but simultaneously to restore nature and mitigate climate change. Doing all this requires a big transformation in land management practices, coupled with developing new skills and attracting enough new entrants to the profession. We need a "just transition" to ensure nobody is left behind in the process.

Since the positive outcomes of restoring nature and mitigating climate change are not always commercially valuable, at least in the current economic system, this restoration work requires government support. And because the overall requirement from farmers is higher than ever before, so too must be the overall level of that support.

Current DEFRA figures show that less than half of the total farm income is earned from farming activities themselves. Two main government subsidies contribute 34% of total farm income in the UK, with diversification such as holiday homes and wedding venues adding another 20%. This varies for different types of farms, with livestock farming most susceptible to changes in government subsidies.

Calls to reduce livestock numbers, as a necessary part of reducing the UK's emissions and restoring natural habitats, have understandably caused concern among some UK farmers in the context of already precarious economic circumstances.

Farmers need to be adequately supported in a transition to a more sustainable food production and to land management that creates more space for nature. This transition needs to allow farm businesses to thrive alongside wider rural communities. Fair pay for food produced in a more sustainable way is crucial, and government policies should enable that to happen.

Since the positive outcomes of restoring nature and mitigating climate change are not always commercially valuable, at least in the current economic system, this restoration work requires additional financial and other support.

Alongside financial support, there must be recognition of the challenge to cultural and place-based identities attached to farming practices and landscapes. These are already being threatened by the effects of climate change and will only get worse with increased floods, heatwaves and droughts.

With the right support across policy and society, farmers can lead the rest of society to a sustainable food and farming system and safeguard their own communities and livelihoods against the impacts of climate change.

3. What is regenerative farming, and what role can it play in the transition to a more sustainable agriculture?

Regenerative farming aims to enhance soil health, biodiversity, water cycling and solar energy capture by plants. It includes minimal soil disturbance, grazing plans with rest and recovery periods for the land, and mixed systems such as agroforestry. This results in healthier soil capturing more carbon. It must be said that the term "regenerative farming" is still loosely defined and as such open to misuse; the more strictly defined and widely used term "agroecology" may be preferable.

Carbon capture in soils is showing promising results, particularly where poor land management in the past provides high potential for additional sequestration. Globally, however, the emissions from livestock far exceed the potential carbon sequestration in soils. There is also a finite amount of carbon that can be captured in soil under a given land management practice, sequestration levels plateau over time and carbon can be released in the future if the land is degraded, such as by erosion from excessive rain. Warmer temperatures may cause plants to grow faster, but they also cause organic matter in soils to decompose faster, which is a risk to existing carbon in soils.

In most cases in the UK, land that is currently grazed by livestock could capture more carbon if it were used to restore forests or peatlands than it could through regenerative livestock framing.

Overall, regenerative agriculture brings multiple benefits and can offset some, but not all, of the emissions from livestock farming. At the same time, we need the least productive areas of land to be used primarily for nature recovery and storing carbon in woodlands and peatlands.

4. How much do methane emissions from livestock contribute to climate change, and what do the accounting metrics GWP_{100}, GWP_{20} and GWP* say about this?

Livestock methane emissions currently contribute around 15% to human-induced global warming.

While in the atmosphere, each tonne of methane warms our climate roughly 100 times more than each tonne of CO_2, but methane doesn't last as long in the atmosphere, having a half-life of only around 12 years. In comparison, a large part of CO_2 stays in the atmosphere for centuries. Over a 20- and 100-year period after being emitted, one tonne of methane creates, respectively, around 86 and 26 times more heating than one tonne of CO_2 that was emitted at the same time. These estimates account for the respective behaviours of the two gases in the atmosphere and define the conventional "global warming potential" accounting metrics GWP_{20} and GWP_{100}.

GWP_{20} and GWP_{100} show the true scale of climate heating caused by a one-off emission of methane (for example, from a livestock farm) compared to CO_2 over the 20- and 100-year periods. However, when applied to continued emissions from the same source over many years, both GWP_{20} and GWP_{100} fail to factor in methane's replacement due to its comparatively short half-life. The recently introduced GWP* metric attempts to deal with this issue by focusing on relative changes in methane emissions from a given source over a 20-year period.

GWP* shows that for methane, further climate change is driven primarily by *changes* in annual emissions, whereas for CO_2, further climate change is proportional to the *annual* emissions themselves. However, GWP* can easily be misinterpreted since *it ignores the warming that has already occurred*, caused by recent methane emissions. When using GWP*, it is essential not to confuse a negative value resulting from a reduction in methane emissions (for example, achievable by a reduction in livestock numbers) with a fulfilment of climate responsibilities. Conversely, what GWP* also shows is the climate mitigation opportunity, and therefore responsibility, that is available by making rapid reductions in methane emissions compared to the very high levels seen from today's agricultural system.

There is a strong argument for reporting the different gases separately and setting separate emissions targets to overcome the shortcomings of each of these GWP metrics. And there is an even stronger argument for rapid reductions of methane emissions across all sectors, including agriculture.

5. In situations where land isn't suitable for crop growing, does livestock grazing represent a good alternative?

The UK's uplands used to be woodlands, peatlands and wetlands. We used to have 20% temperate rainforest cover, and healthy peatlands that stored carbon, unlike the 80% of peatlands today that are in poor condition, with many emitting carbon and having impaired ability to store flood water. The UK is now one of the most nature-depleted countries in the world. If we are to restore nature, some of the land reclaimed from livestock farming should be used to restore our lost habitats, which will help capture carbon, store flood water, and increase biodiversity. This also offers opportunities for rural jobs in recreation, eco-tourism, woodland management and conservation projects, all of which could include some grazing in an agroforestry capacity.

It is generally good for biodiversity and fire risk management to have some livestock herbivores on land, although the stocking densities required for optimum nature recovery are generally too low to offer a significant contribution to our food supply. Every piece of land in the UK is different. Some are so infertile that the trade-off between food production and biodiversity is too steep to make significant food production worthwhile. For other land that is unsuitable for crops, an optimal trade-off can be reached in which nature can thrive while not being maximised, and significant but limited animal food production is also possible.

6. What impact does livestock grazing have on important biodiversity habitats?

Globally, humans and livestock have been the dominant land mammals for well over a century, while natural megafauna and other species have experienced a dramatic decline – recently designated as the sixth mass extinction event in our planet's history. The physical mass of all wild land mammals is estimated to be 3 million tons of carbon at present, compared to 60 million tons for all humans and 100 million tons for their livestock.

In the UK, temperate climate with lots of precipitation following the end of the latest "ice age" historically led to a mosaic of natural habitats including woodlands, peatlands, wetlands and grasslands. Unfortunately, after millennia of human interventions, the UK is now one of the most nature-depleted countries in the world.

Our current farmed grasslands are often overgrazed and have low soil microbial life as a consequence of added fertilisers and pesticides. Purely arable farming, which is often proposed as an alternative to livestock farming, also struggles to eradicate fertiliser and pesticide use (question 7). Regenerative farming practices with some grazing or composting can boost biodiversity and deliver healthier soils and grasslands (question 3). To maximise biodiversity on our farms, we need some grazing, and some areas that are not farmed at all, for example by creating hedgerows or small woodlands on field margins.

7. What is the current environmental impact of arable farming, and how does it compare to livestock grazing?

The underpinning debate often over-simplifies this question to an either-or between arable and livestock farming, but the two are frequently connected.

In the UK, more arable land is used for growing crops to feed to animals – primarily for intensive dairy, pork and poultry production – than for human consumption. A reduction in animal production would reduce damage caused by intensive arable farming of animal feed both in the UK and overseas, where it is a major cause of deforestation.

Switching from intensive to regenerative arable farming is difficult without lowering crop yields in the short term. However, a reduction in livestock numbers, which require far larger land areas per unit of nutritional output, will increase the land available for both regenerative arable farming and other forms of nature restoration.

8. How does pasture-fed cattle compare with intensively farmed cattle from an environmental perspective, and at what numbers is it sustainable?

UK pasture-fed cattle emit more methane per cow compared to intensively reared cattle, largely due to their longer life span. However, the full life cycle carbon emissions from attributable to intensively reared cattle vary depending on the source of the feed crops, with imported soya from deforested areas abroad being the worst for climate impact, and consumed in far greater quantities per animal than that of pasture-fed cattle.

Intensive production of cattle can also harm waterways, through large volumes of manure to dispose of and the use of fertilisers and pesticides to grow fodder crops.

Pasture-fed cattle can have some benefits for water cycling, biodiversity and soil health, when part of multi-paddock grazing and other forms of regenerative farming. It also tends to go hand in hand with better animal welfare and less antibiotic use. Overall, pasture-fed cattle are likely to be better for nature and the climate than intensively reared cattle, but both are considerable contributors to global heating and require additional land for fodder that could be used for human food or for nature.

9. What is the environmental impact of imported meat when compared with locally produced meat?

Beef produced in the UK has, on average, around one-third the emissions intensity of global average beef, mainly due to the cattle being predominantly pasture-fed. However, UK cattle as well as sheep often receive feed supplements. These usually contain soy and palm kernel which can come from deforested regions overseas. For other meats, such as pork and poultry, the emissions mostly depend on the source of the livestock feed. Transport emissions are only a small component of the greenhouse gas footprint of meat.

In general, local UK meat nearly always makes a higher contribution to climate change than plant-based alternatives. Furthermore, all meat production worldwide requires considerably more land and tends to have a bigger impact on the climate than plant-based sources of food.

However, there are often wider benefits to locally produced meat, including animal welfare and human health. The UK's farming community has positively lobbied the UK Government to ensure that quality and welfare standards have not been watered down since Brexit.

10. What impact does substituting dietary beef with chicken, pork or fish have on the environment?

Unlike sheep and cows, pigs and chickens don't ruminate, and so produce far lower direct methane emissions. Chickens have the lowest emissions, due to the animals being small but growing fast. The emissions from seafood vary depending on the method of production.

However, there are wider climate and ecological impacts to consider. Most pigs and chickens in the UK are fed human-edible crops such as soy, often grown on deforested lands which causes significant greenhouse gas emissions and ecological breakdown. Nitrogen run-off from intensive pig and chicken farms causes major pollution problems in many UK rivers. Intensive farming of poultry and pigs also presents a disease threat to humans and raises concerns about animal welfare. Many wild fish populations are overfished, while farmed fish spread disease and are often fed on wild fish. Switching from meat to fish does not generally benefit the environment.

Again, shifting our diets to ones lower in all forms of meat, dairy and fish, and including more plant-based foods, will bring the most benefits to the environment.

11. What impact will any reduction in livestock production have on food security?

It is inherently much more nutritionally efficient to grow crops for humans to eat than to grow crops for animals so that we can eat the animals. Therefore, although there is still a place for livestock farming in the UK, an overall shift towards a more plant-based food production system offers a major improvement in food security.

In the UK over 70% of all land is used for agriculture. Of that land, 85% is used for livestock, either directly for grazing animals or indirectly to grow feed. Yet the animal products from this land only account for 1/3 of our calories, and less than half of our protein.

Only 15% of our agricultural land is used for human-edible crops, while 22% is used for growing hay and crops to feed livestock. Additionally, the UK imports 40% of its food demand (by economic value), which makes it vulnerable to shocks in the global food system.

Reducing the land needed for livestock would allow us to increase land for human-edible crops and lower our imports, increasing our food security. Once freed from livestock, land that isn't suitable for crops could be used for habitat restoration, to increase biodiversity, store carbon and mitigate flooding. In the long term, these natural areas will alleviate more extreme climate impacts that would otherwise affect future food production.

12. What role can technology play in reducing farming emissions?

The most prominent new technologies involving livestock are methane blockers, selective breeding, and feeding ruminants in a way that reduces their methane emissions. Non-livestock technologies include indoor and vertical farming (covered in question 13), precision farming, and using remote sensing and AI.

Emerging technologies will be helpful, and perhaps essential, in enabling the transition to agroecological farming practices, but shouldn't be thought of as a substitute for systemic changes in our approach to food production and land management. And given the current uncertainty, emerging technologies like rumination reduction should not be relied on to deliver at scale and without side effects. Indeed, many of the technologies listed above are yet unproven at scale. They also risk disempowering farmers and concentrating power with technology companies.

13. What role do indoor horticulture and vertical farming play in shaping the future of food production and its environmental impact?

Vertical farming ensures consistent produce throughout the year, can yield 5-10 times more food per unit of land than conventional agriculture, and needs less fuel than conventional farming. However, it requires electricity in place of sunlight, and so must transition to additional renewable sources to be low carbon.

There are high initial costs which could limit its adoption, and currently it is only suitable for a limited range of crops, mainly high-value speciality varieties.

Vertical farming and other similar innovative solutions have potential to contribute to global food security, especially in urban areas and/or for niche crops, and to provide a balanced plant-based diet in areas where traditional methods struggle. It could also be crucial for alleviating global pressure on land.

14. How sustainable is the amount of meat and dairy in the current UK diet and global diets?

In the UK we eat 90% more meat and 75% more animal products than the global average. Worldwide 50% of all land is farmed, a cause of unprecedented biodiversity loss. Of this, 77% supports livestock, which produces 18% of all calories and 37% of all protein consumed by humans. The current system relies on large amounts of crops being fed to animals, and this has only been possible in the short term through practices that are highly detrimental to both soil quality and biodiversity.

If the world ate as we do in the UK, we'd need even more farmland. To feed 2050's projected population without needing extra farmland, much of which would come from deforestation, it is estimated that an overall reduction of between 25% and 50% in meat and dairy is needed. This assumes reductions in waste and restrictions on crops grown for bioenergy, and does not take account of either declining soil fertility or the negative impacts of climate change on food production.

Even if UK residents ate exclusively UK-reared meat, which is generally produced with lower carbon emissions and better environmental standards, the current scale of meat consumption in UK diets is not sustainable in terms of the country's overall impact on climate or in terms of allowing sufficient space for nature both in the UK and overseas. And the current UK diet would not be sustainable in the future with a projected higher population.

15. What conditions would nudge people to shift their eating habits towards more sustainable options?

Diets have varied throughout human history, often changing in short periods of time. Historically, most people would have improved their health through greater access to meat. This is no longer the case, however, partly because of the dramatically increased availability of plant-based nutrition, and partly because of rising health risks and nutritional degradation of farmed meat, coupled with overconsumption.

With increased awareness of the climate impact of livestock production, more and better plant-based alternatives available, and more governance calling for reduced meat consumption, there is every reason to believe in the prospect of a societal shift towards more plant-based food options, especially if they can be made exciting, normal and easy.

Over the last 30 years the growing area for horticulture in the UK has reduced by 37%. Changes to land use, as well as a systemic improvement in good food nutrition, cooking skills and direct

connection to local growers, are essential to transitioning to better diets in the UK for our environment and human health.

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