



# UK SHEEP FARMING AND THE SUSTAINABILITY AGENDA

A REVIEW OF THE EVIDENCE AND WAYS TO DELIVER MORE



In association with

School of **Sustainable Food and Farming**





### National Sheep Association

is an organisation that represents the views and interests of sheep producers throughout the UK. It is funded by its membership of sheep farmers and its activities involve it in every aspect of the sheep industry.

This is an NSA publication in partnership with the School of Sustainable Food & Farming at Harper Adams University, summarising the findings of a full NSA report of the same title. Find the full report at [www.nationalsheep.org.uk/our-work/policy](http://www.nationalsheep.org.uk/our-work/policy).

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## REPORT AIMS

- Emphasise the global sustainability challenges faced by society.
- Investigate UK sheep farming and assess its sustainability across a wide range of metrics and global needs.
- Explore the trade-offs when trying to meet sustainability goals.
- Explore the positive and negative outcomes of global trade sustainability within the sheep sector.
- Identify what more could be done by sheep farmers to improve sustainability, and the mechanisms needed to make this happen.
- Showcase positive sustainability on UK sheep farms via case studies.

NSA intends for this report to inform and influence what happens both now and in the future in areas of policy support, market development and practical applications at farm level.

## CHAPTER 1

### What is sustainability? Why is it more than just carbon?

Sustainability is not just a buzz word but an imperative. NSA, as a charitable company working for the long-term interests of its members, feels a responsibility to contribute to the quest for greater planetary sustainability. Many associations are making sustainability claims without the independent evidence to support them. NSA sees the need to accurately assess the current environmental, social, health and economic sustainability of UK sheep farming while also considering what changes the sector will need to adopt to improve further. This report provides answers and direction, but also raises important questions and identifies areas where more can be done.

The UK's temperate climate and varied landscape have resulted in grasslands dominating in both upland and lowland areas. Our reputation as a green and pleasant land is built on a long history of enterprising people managing a pastoral landscape with grazing ruminants to provide the basics of life – food, fibre and other byproducts for nutrition and warmth. Established over thousands of years, UK sheep farming has influenced our landscapes and communities, from sweeping upland and moorlands, to river and coastal pasture, and the traditional grass-based farming rotation in cropping farms – the latter returning with burgeoning interest in regenerative farming. Pasture-based livestock farming has substantially shaped the UK's farmland ecology - soil life, insects, mammals and birds - and has a significant role in our culture and heritage.

You don't have to look far to see evidence of livestock gatherings, trade and the wool industry that much of our wealth was built on before oil and synthetic fibres challenged this most sustainable, renewable fibre. Sheep farming has carved out a reputation for good animal welfare, being extensive in nature and offering management practices that fit with natural behaviour. The sheep sector also stands out in still offering an

## WHAT IS SUSTAINABILITY?

NSA considers sustainability to be defined as a balance between four pillars.

1. Environmental responsibility
2. Economic viability.
3. Health of people, animals and ecosystems.
4. Social acceptability.

achievable first step for new entrants on the farming ladder. Yet the world has changed considerably and the pace of change is increasing.

NSA views sustainability in its widest sense including animal health and welfare, natural resources, landscape management, provision for nature, healthy communities with localised and circular economies, the impact on the wider environment well beyond the farm boundary, social sustainability in terms of consumer demands, and of course the viability and longevity of sheep farming businesses.

Focusing on any individual sustainability metric in isolation is likely to lead to unintended consequences and does not take account of the trade-offs between the many outcomes arising from a surprisingly complex industry. Multifunctionality and holistic thinking are essential factors behind true sustainability, but these are concepts many people find difficult to understand, preferring to consider their specific area of interest in isolation from broader factors. Unintended wider consequences from actions expected to be good for a singular outcome are often not considered and adequately explored.

Chasing productivity alone neglects the potential for environmental gain delivered by farming. Likewise, a focus entirely on the environment could damage viability and the contribution to food security. That is why NSA so strongly believes, when assessing farm sustainability, environmental, economic and social/cultural aspects all come into play and must be considered together.





# CHAPTER 2

## The rationale for holistic sustainability assessments and the risks of focusing on single metrics

Balanced livestock farming lives hand-in-hand with the environment, supporting a wider circular bioeconomy. The ultimate aim of UK sheep farming is to produce food and fibre, yet its reliance on natural ecosystems results in a mutual dependency and multifunctional outcomes where the aims of food production and environmental outcomes are of equal importance.

True sustainability means a holistic view must be taken or we risk isolated aims with unexpected, unintended and potentially undesirable consequences.

All farming systems and management practices influence the environment, and UK nature has adapted over thousands of years to thrive in and around farmed habitats. Therefore, many soil life communities, plant, insect, bird and mammal species are dependent on grazing animals and their effect on soil microbiology, direct ecological activity and vegetation.

Sheep farming has created and maintained some of the most loved landscapes we see and enjoy today. It is no accident that most UK national parks are in areas dominated for generations by sheep and grassland, or that many celebrated UK landscape paintings and literature depict pastoral hill and lowland settings with sheep grazing contentedly in peaceful surroundings, evoking feelings of natural beauty, environmental security and home.

### CASE STUDY: William Egerton

#### Sheep and beef enterprise on a 200-acre family farm in the lowlands of County Fermanagh

Through whole-farm soil sampling, William has been able to correct pH, potassium and phosphorous, reduce fertiliser use and improve overall soil health.

“So far I have been able to graze the same amount of livestock on the same area of land with 50% less artificial fertiliser,” says William, adding that fewer applications has also saved on diesel and reduced soil compaction caused by tractor tyres on fields.

“This has had a positive effect on the financial sustainability of the farm and reduced the carbon footprint. Multi-species swards are also helping reduce anthelmintic usage on farm and are having a positive effect on daily liveweight gains.”

Having struggled with excessive rain and weeds when encouraging clover and establishing multi-species swards, Williams says: “I think more trials and experiments on how to grow clover and multi-species swards in wet, challenging conditions, and also showcasing the benefits they can have on anyone’s farm would encourage other farmers to take this practice on.”



Not surprisingly this unique environment, working in harmony with well-managed sheep farming, is invaluable for its effects on water management and quality, carbon sequestration and nature, but also provides people with social and health benefits, such as open space for exercise and mental wellbeing.

With climate change resulting in more extreme weather conditions, including the increasing risk of extensive wildfires, the value of a diverse, sensitively managed, resilient grazed landscape should not be ignored.

There is a real need to think of climate change and nature recovery not in isolation but to consider them with the protection of natural resources, national identity, heritage, rural economies, links to tourism, human health and wellbeing, and local food production and consumption.

There are many opportunities to further improve our farmed environment and to lower greenhouse gas emissions without compromising food production. After all this is the foundation of the Paris Climate Change agreement. Yet previous policies have not been holistic in considering unintended outcomes, leading to negative consequences. For example, headage payments in the 1970s, 80s and 90s focusing on livestock numbers alone, leading to overstocking. Without a more complete and rounded analysis of UK sheep farming and the positive role it plays in the fight against climate change, nature recovery and the protection of natural resources, the threat of negative results looms again.

UK sheep farming delivers for the environment through both a land-sharing and a land-sparing approach, with grazing and farming activity providing for the environment (habitat creation and biodiversity), as well as specific areas targeted to environmental outcomes such as areas of woodland, peatland, hedgerows, scrub and water bodies.

Sheep farms of the future are likely to have a spectrum of land management approaches dependent on the objectives and value of that land – from a focus on productivity to a focus on the wider environment – and with a range of different activities in between. Such local and national diversity will benefit not just our landscape and nature, but also our reputation and economy.

Farmers must be increasingly engaged in environmental work but need to benefit financially from these actions to ensure productive and efficient food creation alongside providing for nature and society. NSA stresses the critical need for food production to be seen as a public good in the eyes of decisionmakers, consumers and the wider public. There is a case for appropriate incentives for different approaches – the contribution to food security is one level but the contribution to the local rural economy of someone with a farm shop selling specialities and food with provenance has wider benefits for society.

Looking at sheep farming through a holistic lens ensures the true multifunctionality of UK sheep farming is represented, reducing the risk of alternative land use strategies becoming a reality.

### CASE STUDY: Lorraine Luescher

#### 3,000 ewes in a hefted upland system running over 5,400 acres of Scottish hills



Good use of preventative medicines and utilising traditional farming methods adapted to modern challenges ensure excellent flock health and welfare for hill farmer Lorraine.

“I run hefted hill sheep flocks with an emphasis on high welfare. This type of extensive grazing system is the ultimate sustainable farming solution for less productive ground with benefits to landscape, habitats and biodiversity and to economic activity often in remote areas,” explains Lorraine.

Flock management focuses on high welfare and disease prevention, replacing ewes from homebred sheep to ensure hardy genetics and inbuilt immunity to ticks.

“Sheep scab is endemic in many hill areas and is a constant threat. Identifying health issues such as OPA is an important part of what we do and ensuring correct nutrition and mineral balance are also key,” adds Lorraine.

Low impact grazing assists delicate plant species as well as soil preservation supporting carbon storage and well-maintained stone walls providing valuable nesting habitats and sheep shelter. “The practice of hefting sheep has been used for centuries, however the proactive approach to flock health and welfare is what singles my system out,” she says.

“Change of land use to forestry and rewilding are threatening the hill livestock sector. We need better political recognition and financial reward for the public goods – food, climate and nature – delivered by livestock farming.”





# CHAPTER 3.1

## Positive attributes: Trends in sheep carbon footprints

Sustainability extends far wider than greenhouse gas emissions, or even carbon footprints, yet global concerns over climate change have made emissions the primary focus for government, the supply chain and consumers.

Despite this, there is relatively little current information on the carbon footprint of UK sheep production. The media regularly quotes data based on global averages, and even national data is based on generic figures that are misleading and make evidence-based decisions impossible.

Sheep production carbon footprints vary between sheep farming nations and individual UK farms. While UK footprints are lower than many global values, emissions per ewe increased between 1990 and 2018 because of a trend toward bigger breeds and heavier slaughter weights. This demonstrates the need to better understand the effect of productivity goals on emissions and how they are calculated and accounted for on farm.

Days to slaughter has a major influence on methane, although full lifecycle analysis carbon footprints can reveal carbon sequestration opportunities to offset higher emissions across the sector.

Since 2009, the total UK sheep emissions and intensity (kg CO<sub>2</sub> per kg lamb) have remained stable. With beef, dairy and pig emissions declining, sheep farmers are likely to come under increasing scrutiny and will need to demonstrate dedication to reducing emissions as well as improving carbon footprints.

Enteric methane is the greatest contributor to greenhouse gas emissions in grazed sheep systems, followed by manure deposition then fertiliser and feed. Whether you accept enteric methane is responsible for global warming – given that methane from grazed animals has been part of a natural gaseous cycle for thousands of years – it's indisputable that reducing methane emissions will help and is a government target.

Individual farm footprints vary considerably, further affected by inconsistencies between different carbon calculators. Given the need for all farms to strive to reduce emissions and increase sequestration opportunities, NSA believes carbon footprints should not be used to penalise or praise individual farms, but instead provide a benchmark to measure future improvement.

## CASE STUDY: Hayden and Melissa Wooley

**4,000 wool-shedding ewes on 450 owned acres and 1,250 rented acres in Shropshire**



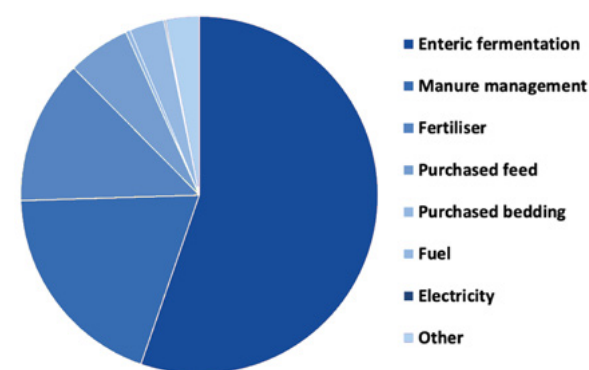
*Using genetics to remove labour, increase efficiency and ultimately lower emissions is the driving force behind innovations being implemented by Hayden and Melissa.*

*Melissa says: "We have imported genetics and embarked on progeny testing with a view to improving flock efficiency. Portable accumulation chambers are used annually to test lambs for methane efficiency alongside embryo transfer to accelerate genetic gain. Methane per kg of lamb sold is a good measure of overall flock efficiency and we hope to produce animals with 35-40% lower genetic emissions within just five years. We aim to further compliment this gain with better nutrition and improvements recommended by Defra's Animal Health & Welfare Pathway increasing productivity."*

*This approach to flock genetics is expensive but Hayden and Melissa have recently been awarded a Farming Innovation grant and they believe the need for further financial efficiencies on farm alongside changing consumer demand will encourage more farmers to change their practices in time. At present their whole farm sustainability strategy includes solar panels, biomass heating, environmental stewardship, hedge planting, herbal leys, cover crops and direct drilling.*



### Crossbred ewe carbon footprint



STRATEGIES TO REDUCE GREENHOUSE GAS EMISSIONS FROM UK SHEEP SYSTEMS	
PRODUCTIVITY	<ul style="list-style-type: none"> <li>Finish lambs earlier.</li> <li>Lamb ewes younger.</li> <li>Improve ewe longevity.</li> <li>Minimise mortality.</li> </ul>
GENETICS	<ul style="list-style-type: none"> <li>Select for low methane emissions.</li> <li>Select for optimal litter size.</li> </ul>
FEED CHOICE	<ul style="list-style-type: none"> <li>Byproduct feeds.</li> <li>Supplemental feed.</li> <li>Feed additives (e.g. seaweed).</li> </ul>
PASTURE	<ul style="list-style-type: none"> <li>Multispecies swards.</li> <li>Rotational grazing.</li> <li>Integrate grazing into arable rotations.</li> </ul>

Greenhouse gas mitigation measures must be applicable to the farm situation, result in an improvement (or at least no change) in economic viability and should have multiple positive impacts across a range of metrics, without significant negative trade-offs.

Strategies to reduce emissions will vary and are not always based on farm size or type but revolve around efficiency. Optimising nutrition, grassland management, genetic merit and animal health can reduce emissions. For example, improving lamb growth rate to reduce age at sale or slaughter, enhancing carcass conformation, increasing the numbers of lambs weaned per ewe, lambing ewes at 12 months of age to maximise productive life, optimising culling rate to reduce the number of ewe lamb replacements required, and improving feed efficiency will all help improve productivity and should reduce emissions and resource use.

Reducing the number of unproductive animals and achieving target weights faster – so stock is on-farm for less time – will result in lower emissions. This also frees-up land as less is required to maintain current levels of output, allowing room for other offsetting strategies. Given some emissions are unavoidable, offsetting through increased sequestration opportunities will play an important role when assessing full carbon footprints.

Further gains may be achieved by introducing supplemental feed, where necessary, improving pasture management, using multispecies swards and rotational grazing, and exploiting byproduct feeds. Careful feed ingredient choice, such as no soya, can reduce ration emissions and feed additives directly impact rumen methane emissions. Meanwhile, improved sheep health alongside breeding and feeding management leads to waste reduction, productivity gains and more responsible medicine use.

With all this, there remains the importance of considering the bigger picture. While fewer days on farm means lower emissions, the environmental impact and cost of home-grown versus bought-in feeds needs to be considered. Likewise, reducing days to slaughter as a single primary aim would increase peaks and troughs in lamb production, which could affect consumer preference on taste and quality, and potentially reduce sheep breed diversity.

# CHAPTER 3.2

## Positive attributes: The role of UK grasslands in the delivery of public goods

Grasslands are the cornerstone of sustainable UK sheep production. From extensive, unimproved upland and lowland pastures and semi-natural hay meadows, through to improved rotational pastures and intensively managed temporary grass, clover and mixed species leys, grasslands are highly diverse in nature and the most widespread terrestrial ecosystem.

Aside from their economic importance as the primary food source for grazing livestock, grasslands play a vital ecological role – contributing to biodiversity conservation, soil fertility, water management and carbon sequestration – as well being culturally important to tourism, heritage and tradition, food provenance, and offering recreational access for activities linked to mental and physical wellbeing.

### Biodiversity

UK grasslands host a multitude of important plant and animal species, provide for soil life, support pollinators and, when grazed, also provide dung for invertebrates. Defining and assessing biodiversity is complex due to the broad nature of biodiversity and multitude of indicators available – but we know degradation of grasslands over time through poor management can lead to reduced vegetative and animal productivity, declines in soil organic matter, nutrient availability, soil compaction and erosion, and habitat loss.

It's estimated up to 90% of semi-natural species-rich grassland has been lost in lowland UK since the 1940s, due to intensified agricultural production and



conversion of this land to either improved grassland or arable. Historical headage payments created concern in the 1980s and 90s, but area-based support payments during the early 2000s have significantly diminished the economic rationale for maintaining high sheep stocking rates, slowing the rate of UK grassland degradation significantly.

At the opposite end of the scale to overgrazing, inadequate livestock grazing can also negatively impact biodiversity and the conservation value of grasslands. Grazing controls the growth of coarse and aggressive grasses, prevents the encroachment of woody plants, invasive species and scrub, and disperses seeds across long distances via dung, but sheep are selective grazers so careful management is vital.

Lower management intensity can bring biodiversity benefits but provides less high-quality animal feed – therefore identifying and implementing management practices to support multiple ecosystem services and grassland multifunctionality will be key in the transition towards more sustainable sheep production.

## CASE STUDY: Richard Thomas

**250 ewes, cattle, cider apples and solar panels on a 300-acre lowland Herefordshire farm**

*A desire to change and implement modern practices while adapting solutions to individual situations is how Richard believes farming will continue to thrive.*

*“Our farm is a more functional ecosystem now. It’s a long road though so it will take time for all the benefits to be seen,” he says.*

*On Richard’s farm rotational grazing with longer rest periods has increased skylarks; tree planting has improved habitats, shelter and water holding capacity; laying hedges has increased yellowhammer populations; and better parasite monitoring and vet engagement has bolstered animal health alongside responsible medicine use.*

*He says: “Our sheep are profitable and that hasn’t always been the case. As farmers we tend to spend time worrying about what we can’t control – weather and policy. Recent rainfall has been unprecedented but mitigation is easy – more trees and hedges for shelter and better genetics for flock resilience. Every farm is different and so are the solutions, but the desire to change has to come from you first. We must find a way to focus on the environment and our farm’s social license before legislation makes the changes for us.”*



## FUNCTIONS OF BIODIVERSITY

1. Patrimonial – conservation of landscape aesthetic and threatened species.
2. Agronomical – soil fertility and nutrient cycling, pollination, pest and disease control.
3. Ecological – species habitat and ecosystem resilience.



## Soil health

The productivity and functionality of grasslands, and therefore livestock grazing, play an important role in maintaining and improving soil health. Organic matter and nutrients are returned to the soil via livestock excreta, supporting soil nutrient cycling, which in turn supports plant growth and regeneration.

Grazing intensity is a key driver for altering the physical, chemical and biological structure of soil, in conjunction with climate conditions, soil type, vegetation cover and stocking method (livestock numbers, grazing period and rest periods). Although agriculture is often blamed for soil loss, new housing, roads and transport, sport grounds, golf courses and gardens also impact soil structure, health and habitats.

## Carbon sequestration

In an era of growing concern about climate change, the role of UK grasslands as highly valuable carbon sinks (sequestering CO<sub>2</sub> from the atmosphere into the soil) needs greater recognition and understanding.

Although many agricultural soils, particularly those under permanent grasslands, are likely to be near or at a state of carbon equilibrium it is still vital to maintain soil organic matter levels and carbon sequestration in these grassland soils. A key example of where sheep grazing may significantly help improve soil carbon sequestration and other soil characteristics is through the integration of livestock into arable systems.

## CASE STUDY: Ian May

**450 ewes plus suckler cows on 330 acres of upland and lowland areas of North Devon**

*Balancing sustainability, realistic expectations and a profitable business are key priorities for Ian.*



*“It is important farmers demonstrate we are good custodians of the countryside. I want to help show this can be done while producing quality food. I look for easy wins on-farm where it is good for the environment but also good for the business,” he says.*

*Ian is using Countryside Stewardship grants to create and maintain new habitats such as woodland areas and reinstating hedgerows to divide fields and allow increased rotational grazing to improve soil health, along with herbal leys, potentially allowing for a reduction in fertiliser use. Already Ian is seeing benefits in biodiversity.*

*Using increased faecal egg counts and working closely with his vet should improve lamb growth rates and promote responsible medicine use, improving animal health, reducing costs with knock-on sustainability benefits.*

*“The system needs to fit in with individual circumstances and constraints – farm size, weather, soil type, finances and staff willingness. I’m a strong supporter of peer-to-peer learning, especially with the proliferation of new schemes. Go and talk to your neighbours, see what they have done and how their actions can be applied to your situation,” he says.*



## Other ecological outcomes

Grassland, sheep farming and the environment are all intertwined. Therefore a holistic and sustainable approach to the full range of ecosystem provisions (functional landscapes, food security, sustainable livelihoods and socio-cultural values) is essential, integrating adaptive strategies and innovations.

Ongoing efforts to protect and manage grasslands sustainably are crucial for ensuring the continued success of UK sheep farming while preserving the invaluable natural resources that underpin it.

The focus of UK governments on policies for the environment and nature is ensuring UK wildlife has increasingly improving habitats. Grassland must be central to these improvements, because the success of many native wildlife lifecycles is directly linked to livestock grazing providing food and a favourable environment.

UK grass-based livestock farming should therefore be seen as a key contributor to these efforts and indeed a mechanism to reach net zero, including via carbon sequestration, while also providing additional benefits to meet more societal interests encompassing sustainability.

The UK climate and weather conditions are perfectly suited to growing grass and forage plants. Even with climate change, grassland plants - as permanent pasture and short-term leys within a mixed farming rotation - will continue to be one of the most resilient and stable crops/habitats available.





# CHAPTER 3.3

## Positive attributes: Feed and land use

Healthy soil is the foundation of sustainable food production. Soil contains an astonishing diversity of microorganisms and insects with ecosystems that function through digesting waste plant material, converting inaccessible nutrients into utilisable ones by plants, facilitating nitrogen fixation in leguminous plants and developing a flexible and adaptable soil structure. This enables soil to withstand mechanical, chemical and climatic challenges, balance pathogenic organisms and, crucially, hold or release water.

Grazing sheep play an integral part in soil health. Manure deposition (from grazing animals or manure spreading) in well-managed grazing systems has a positive effect on soil fertility through direct inputs of nitrogen, phosphate, potassium and sulphur.

Introducing rotational grazing and monitoring grass growth allows producers to increase grassland utilisation and stocking rates. Mob grazing mimics natural grazing regimes from which modern grasses evolved, maximising photosynthesis and productivity, reducing selective grazing, improving soil organic matter content and enhancing the provision of wildlife habitats. Improving grassland productivity also has synergistic positive impacts on sheep performance through improved health and nutrition.

### Sustainable feed use

Compared to pig and poultry, feed contributes a lower proportion of greenhouse gas emissions per kg of lamb, yet high quantities of purchased feeds can have a significant effect on whole lifecycle footprints and emissions, particularly if they include soya.

Producers using more homegrown feeds should in theory reduce emissions compared to purchased feeds – but supplementary feed can still bring advantages if, for example, homegrown feed is unavailable, cannot be produced efficiently or does not have sufficient nutrients to support productivity.

Providing supplemental feed before tupping or lambing to improve conception and lambing percentage can boost productivity, and bought-in feed can ensure lambs are finished quicker to relieve grazing pressure and cut enteric methane. Therefore potential benefits must be weighed against the environmental and economic cost.

The environmental impacts of feed production are reduced further by utilising human food/fibre byproducts, such as sugar beet pulp, maize gluten and rapeseed meal. Where sheep are integrated into

arable enterprises, this can also include straw and vegetable byproducts.

Feed efficiency is also a key consideration, as breeding sheep with an improved feed conversion should reduce both feed and land use – there is ongoing trial work in this area, such as the Breed For CH4ge project. Improving feed efficiency may also reduce enteric methane emissions as a greater proportion of energy is used for performance rather than lost as methane, but this is under debate. Nevertheless, given enteric methane is the greatest contributor to the carbon footprint of sheep operations, feed ingredients that reduce methane output while maintaining or improving performance should improve sustainability.

Condensed tannins, essential oils, seaweed and the 3-nitrooxypropanol feed additives have all been used to reduce methane emissions, although results have been inconsistent and not all products are commercially available for sheep. The pasture-based basis of sheep production means feed additives are more difficult to incorporate into diets compared to animals fed a daily ration, so they should not be considered a silver bullet for all systems.

## Integrating into arable

Converting grassland to arable has negative impacts on the diversity of important soil microorganisms and reversion back to grassland does not completely reverse these changes. Homogenous arable landscapes have also been associated with biodiversity reduction.

Inclusion of a well-managed grazing ley, cover or fodder crop in the arable rotation delivers a range of benefits – as long as stocking rates are suited to the available resources, sheep are temporarily removed to allow plants to flower and bare soil is avoided over winter. Sheep are also being used within viniculture systems to improve overall productivity and weed/vegetation control.

While the grazing behaviour and weight of sheep means they have fewer negative impacts on soil structure than cattle, operating a mixed grazing system, either alternating or combining cattle and sheep grazing, may provide further opportunities for improved productivity, improved sward density and enhanced ecosystems.

The synergistic benefits of sheep in arable enterprises to whole system productivity may outweigh the performance of individual enterprises. For example, soil under grass or fodder crops tends to be less susceptible to erosion (not least because of fewer tillage operations) which can benefit later arable crops. Over-grazing can cause soil compaction and reduce arable yields, but this can be avoided by restricting stocking rates.

Carbon sequestration is a major sustainability benefit of integrating sheep into arable rotations, although the impact of this is affected by previous soil management, stocking rate and soil type.

### CASE STUDY: Perry Parkinson



#### First generation farmer managing commercial ewes over 750 acres of arable and grassland in lowland Stirlingshire

*A trip to New Zealand - funded by the NSA Samuel Wharry Memorial Award - where he witnessed the negative effect of resistance by sheep worms to anthelmintic treatments inspired first generation farmer Perry Parkinson to change his own farming practices.*

*"By implementing all our management decisions in conjunction with working alongside the arable enterprise, we have really cut down our anthelmintic use and are already seeing the benefits," says Perry, explaining that reduced use of worming products reduces the speed at which resistance develops.*

*The farm carries out regular faecal egg count testing, rotates stock on clean reseeded behind cereal crops, carefully chooses anthelmintics depending on the time of year and selects stock that is more resilient to worm burdens. As a result, no anthelmintics are now used on ewes, lambs are reaching their target weights quicker and there are fewer instances of high worm burdens in lambs.*

*"We're not only reducing additional costs on farm, but reducing the amount of chemicals expelled in sheep dung, reducing the rate at which resistance develops and putting goodness back into arable rotations, which in turn reduced the need for chemical fertilisers. Herbal leys and legume crops are naturally fixing nitrogen back into the soil free of charge," says Perry.*



#### BENEFITS OF LIVESTOCK IN ARABLE AREAS

##### FOR SHEEP

- Nutritional benefits of diverse swards.
- Improved liveweight gains from clean grazing.
- Additional grazing opportunity.
- Anthelmintic benefits of diverse forage/clean grazing.
- Outwintering to reduce housing costs.
- Opportunities for new entrants.

##### FOR ARABLE

- Improved soil health.
- Additional income opportunities.
- Better crops in subsequent years.
- Reduced mechanical mowing.
- Weed control.
- Environmental payments.

##### FOR THE ENVIRONMENT

- Ecosystem enhancement.
- Increased yields.
- Increased biodiversity.
- Reduced flooding / buffer against drought.
- Carbon sequestration.

Long-term experiments have shown increases in the organic carbon of topsoil where grazed grass/clover leys are included in the arable rotation. The increases only continued until the soil reached an equilibrium, but were considerable compared to losses from all-arable or root crop rotations over the same period.

Grazing leys, cover and fodder crops within an arable rotation provide clean pasture, which can control gastrointestinal parasite loads and, by extension, reduce the need for parasiticides, which can negatively impact biodiversity when excreted in sheep dung. Some plant species also offer anthelmintic properties, again reducing pesticide use.

Introducing grazeable crops and livestock into the arable rotation can provide a holistic method of weed control. Leys create an inhospitable environment for weeds by competing for water, nutrients and light; compromise weed growth through cutting for hay or silage; have lower nitrogen applications; and in some species – for example, lucerne or trefoil – release specific inhibitory compounds. Yet the success of weed control depends on rotation characteristics and management.

Although sheep integration provides benefits for arable farmers, it must be economically viable. Cover crops or leys must be profitable or improve whole farm financial viability to ensure the balance between economic, environmental and social factors remains stable. Some cropping options that work well with livestock are now also eligible for government funding, due to their environmental benefits.



# CHAPTER 3.4

## Positive attributes: Trees, hedges and woodland

With 30-50% of countryside trees - outside of woodland - lost over the past 150 years, and 50% of hedgerows removed from agricultural land since the 1940s, tree planting is now seen as an important tool for the UK to help meet its pledge of improving the environment and reaching net-zero targets.

Trees are also an important tool for balancing greenhouse gas emissions arising from sheep production and lower carbon footprints at an individual farm level – but they are not the only tool. We must recognise the wider value of grasslands within multifunctional, resilient landscapes made up of soils, pasture, trees and hedges, each with their own carbon value.

Taking land out of agricultural production to achieve tree planting targets creates conflict between land used to produce food/fibre and land use for carbon sequestration and nature. Mass afforestation also poses a threat to the biodiversity and other ecosystems services grassy-biomes provide, particularly in the case of natural, semi-natural and improved low-input grasslands. Furthermore, afforestation of grasslands using flammable plantation trees could increase the risks associated with wildfires.

### INTEGRATING TREES ON FARM

There are two main routes to increase tree cover on agricultural land

1. Afforestation whereby grazing livestock are excluded from wooded areas.
2. Agroforestry whereby grazing livestock and trees are integrated with one another, for example via wooded pastures, silvopasture, hedgerows, shelterbelts and row systems.

## CASE STUDY: Bryan and Liz Griffiths

### 750 breeding ewes plus fattening cattle on a 320-acre lowland farm in North Devon

With a growing awareness of environmental responsibilities and a desire to reduce overgrazing, Bryan and Liz have utilised government funding to enhance biodiversity and work more closely with nature.

“We have divided large fields, created new hedgerows and fenced off less productive areas to increase wildlife habitat,” explains Bryan. “We have also been maintaining and increasing the diversity in grass swards and reducing overgrazing and poaching through more rotational grazing instead of set stocking.”

The couple have seen an increase in flora and fauna, less soil run off and a reduction in the use of chemical fertilisers using their new systems – but have had to manage the financial implications carefully.

“One challenge to changing our land management is understanding the financial impact of any proposed actions, such as reduced stocking rates and reduced inputs,” says Bryan. “Liz and I believe information should be easily available to farmers considering a more sustainable approach to their farming. Local, facilitated discussion groups to disseminate information on environmental and funding opportunities would be a real asset to encouraging more of us to adopt environmentally beneficial practices.”



The approach in the UK of either forestry or farming is not mirrored in other parts of the world. In many Mediterranean countries, for example, practices that integrate livestock production with trees are more common. The pressure that ever-increasing demand for food, feed, fibre and fuel is putting on land, which is a globally finite resource already being negatively impacted by climate change, is bringing multifunctional land use into focus. As such, the benefits of integrating trees with livestock production are likely to outweigh the benefits of each in isolation. More support for localised and small-scale processing, product innovation, development of specialist markets and small-scale energy production, would back the commercialisation of multifunctionality.

Aside from carbon sequestration and water storage potential, tree planting improves sheep welfare by providing shelter, shade and windbreaks from adverse weather extremes which are regularly experienced in the UK. Fodder from trees can also be used to feed livestock, a practice common in tropical regions but less well studied in temperate regions, despite some containing compounds that are both beneficial to sheep and lower methane and ammonia emissions. The presence of trees can help protect soil from erosion and improve water infiltration and water holding capacity, in turn helping reduce surface runoff and provide flood risk mitigation.

Tree establishment on sheep farms requires careful management, particularly in the first few years after planting given the rubbing and browsing behaviour of sheep. Careful consideration also needs to be given to the type(s) and species of tree being planted, planting design and density.

Tree planting offers additional business opportunities for selling timber or fruit, but there are long lead-in times before income is realised. Emerging public and private grant aid is becoming attractive to support multifunctional land use, both as revenue and capital payments in recognition of the provision of public goods.

Yet productive land should not be sacrificed for net zero efforts such as blanket forestry – the right tree in the right place must be the ambition. Active farmers need incentives and reward for sequestering carbon, and encouragement to consider renewable energy production options.

These measures, along with tempering rampant enthusiasm for planting grasslands with trees, would mean UK sheep farmers may not just find net zero achievable, but deliver on a more far-reaching assessment of sustainability.

## CASE STUDY: Mike Adams

### 300 ewes on a 325-acre lowland beef, sheep and arable unit in Rutland



Having started as a first generation farmer 20 years ago, Mike's newest self-set challenge is agroforestry planting five alleys of broad leaf, fruit and nut trees, including hazel for coppicing.

“I decided to implement this system following trips to Europe with an Erasmus project NSA was involved in. I saw the impact agroforestry had on farms where climate extremes are far worse than in the UK,” explains Mike.

“We haven't seen the full benefits yet, as the trees were only planted last winter. However, there are already noticeably different insects visible in the alleys. Even the tubes and guards are slowing the winds down, so they will definitely provide beneficial shelter and shade in a few years' time. Tree alleys make a great template for mob grazing.”

Mike is already planning further planting with browsable willow and more coppicing trees, but admits this wouldn't work well for all farms.

“It's a long-term project which would be a challenge on tenanted land. Our fruit trees will be six or seven years until full production, which wouldn't work on the land we have on a five year farm business tenancy agreement” he explains.

He is hoping funding for similar projects under the government-funded Sustainable Farming Incentive will tempt more farmers to consider agroforestry and, in time, there will be more published case studies showing the benefits of such schemes.





# CHAPTER 3.5

## Positive attributes: Health and welfare credentials

Proactive flock health planning that prioritises preventive medicine has led to excellent health and welfare in UK sheep flocks, alongside improved efficiency, environmental footprints, sustainable medicine use and job satisfaction. Healthy, productive flocks are the foundation for profitable and sustainable businesses.

Animal health and welfare is increasingly important to the public and, given that UK agriculture is governed by some of the strictest regulations in the world, we have among the highest standards of any farming nation – coupled with additional voluntary assurance schemes, veterinary attestations for exports and other industry codes of practice.

While consumers may feel it is the farmers' responsibility to continue to improve animal welfare, on-farm costs can temper potential improvements. However, the governmental drive for farmers to invest and build on priority health and welfare areas with veterinary guidance can be seen in new, funded animal health initiatives, assisted by equipment and technology grants to encourage and enable on-farm investment.

The UK sheep sector continues to strive towards a unified approach to balancing and optimising the health of people, animals and the environment, known as One Health. Responsible medicine use is advocated through the collaborative and coordinated work of industry-led groups such as the Responsible Use of Medicines in Agriculture (RUMA) Alliance, Sheep Vet Society, and Sustainable Control of Parasites in Sheep (SCOPS). The UK Sheep Welfare Strategy, led by the Ruminant Health & Welfare Group (RHWG) has six strategic goals and is another example of an industry-led initiative to drive improvements. And the E-Medicines hub will allow regional and national trends in medicine use to be built into future policy drivers.



### CASE STUDY: Pauhla and Martin Whitaker

**310 organic breeding ewes plus suckler cows on 560 upland acres in Gloucestershire**

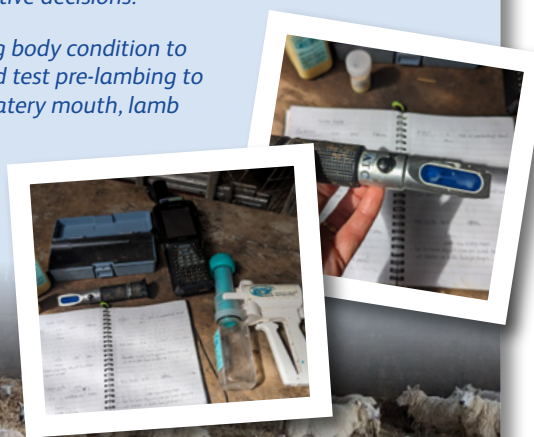
*Targeted monitoring of ewes and lambs to reduce medicine use is improving flock health, lowering culling rates and resulting in faster finishing lambs for Pauhla and Martin.*

*As an organic flock, the couple were already focused on good health and disease prevention but worked closely with their vet to develop a flock health and management plan with an emphasis on a robust and resilient flock with minimal intervention.*

*"Making a positive spend on testing and diagnostics leads to savings elsewhere and is well worth the investment," says Pauhla. "Simple diagnostics can be done pen side helping you make proactive rather than reactive decisions."*

*Vaccination and parasite monitoring play a key role, while monitoring and maintaining body condition to ensure ewes provide good colostrum is critical for lamb management. The couple blood test pre-lambing to check ewe nutrition status. They also measure colostrum quality, which has reduced watery mouth, lamb mortality and mastitis.*

*"When you have a problem, get your vet involved," advises Pauhla. "We ask ours to blood test a small number of lambs, checking for passive transfer of immunity from colostrum. It's a worthwhile investment as it tells you if those lambs really did get enough good quality colostrum or if you have another underlying issue."*



### CASE STUDY: Ernie Richards

**Managing 1,000 ewes on a 350-acre upland farm in Powys**

*Careful selection and breeding are key to producing quality, healthy pedigree Lleyn sheep, keeping costs low and maximising sales for first generation shepherd Ernie, who works for Stuart and Helen Morris on their upland farm of permanent grassland and new leys.*

*Flock health is also a priority, with Ernie adopting a more proactive approach to vaccination in recent years in both the breeding flock and prime lambs. "We feel prevention is a lot better than cure, therefore using a core vaccination policy is the best way to prevent contagious diseases and problems," says Ernie. "Trying to reduce our antibiotic usage is also a big part to become more sustainable and ensure resilience."*

*He strongly believes a healthier flock leads to more sustainable protein production and higher welfare standards, therefore reducing the carbon footprint. To encourage more farmers to adopt a similar practice, Ernie would like to see better understanding of responsible medicine use and government support to create a national flock fully vaccinated against contagious diseases.*



### Vaccines

Animal vaccines are widely recognised, not least in the One Health agenda, as having the ability to prevent and protect animals against diseases to improve health, reduce antibiotic use, increase productivity gains and reduce carbon footprints. Sales of sheep vaccines increased by 12.6% between 2012 and 2021, indicating progress in this area but, more recently, vaccine use has been hampered by serious inconsistencies in production and supply.

Achieving self-sufficiency in high-quality, responsibly produced food requires secure and reliable production of vaccines and other medicines, which should be accepted by the government and society as being of national strategic importance.

### Parasites

Gastrointestinal nematodes are still one of the biggest factors behind productivity losses in the UK sheep flock, and will become more challenging to control in the future as resistance to anthelmintic treatments continues to develop. Increasingly responsible use of parasite control products will be essential to guarantee future animal health and welfare, flock productivity and business viability, with implications for greenhouse gas emissions of sheep production and the UK's ability to reach net zero targets.

### Lameness

Uncontrolled lameness poses a concern for animal welfare, with economic and productivity losses occurring from treatment costs and reduced performance, and implications for industry reputation. The five-point lameness control plan has achieved industry-wide recognition and continued uptake will reduce flock lameness and allow the sector to achieve individual and national targets.

### Iceberg diseases

There are a range of sheep diseases with low levels of clinically diagnosed animals but many sub-clinically affected individuals. These significantly impact health, performance, longevity and, subsequently flock productivity and profitability. Greater encouragement and incentivisation of regular farmer-vet discussions alongside the development of better (ideally pen-side) diagnostic testing is improving awareness of iceberg diseases and linking them to better biosecurity measures, stricter culling policies, more responsible stock sourcing and enhanced quarantine procedures.

Good progress has been made with maedi visna testing and accreditation. Testing for Johne's and borders disease is also available. Some progress is being made with the identification of OPA through scanning, but wider uptake will increase productivity and reduce carbon footprints.



# RESPONSIBLE MEDICINE USE

The long-term sustainability of the UK sheep sector relies on the efficacy of key animal medicines – notably antimicrobials (mainly antibiotics) and parasiticides. Animal health and welfare, animal productivity, and therefore carbon footprints, rely on them.

To slow down the development of resistance to these medicines, for the sake of animals, humans and the planet, it is vital they are used responsibly – as little as possible, as much as necessary.

Through the work of Responsible Use of Medicines in Agricultural (RUMA) Alliance, UK livestock sectors have significantly reduced antibiotic use by encouraging proactive flock health management and best practice. The biggest reduction for sheep has been the move away from oral antibiotics in young lambs. There may be situations where farmers understand the actions required and want to implement change, but resources are not always available or are unaffordable, as highlighted over 2022-2024 with issues surrounding vaccine availability and supply.

The Sustainable Control of Parasites in Sheep (SCOPS) Group is another example of where an industry-led group has generated and shared best practice advice on sustainable use of animal medicines – promoting the fine line between ensuring animal health, welfare and performance (the latter linked to lower carbon footprints) while cutting anthelmintic usage (to slow the speed of resistance developing, cut costs, save time and reduce the amount of chemicals passed in animal dung).

## Breeding and genetics

Improving farm-level genetics starts with recording – and the UK is gradually increasing and developing recording at individual flock level and through larger performance recording systems, including those using genotyping and other emerging technologies. Recording and creating estimated breeding values for a range of maternal traits, such as longevity, milk yield, and immunity and resistance to parasites, is driving health and welfare improvements at the same time as improving productivity. Continued uptake of this is key to sustainable improvement.

Advancements facilitated by the Genetic Technology (Precision Breeding) Act 2023 may open up future health and welfare improvements via the insertion of resistance genes into livestock – but tight and effective controls will be needed to avoid any short or long-term negative consequences.

## Other interventions

Castration and tail docking are under discussion in terms of welfare and productivity. Both of these are permitted under legislation and widely used in the UK. Both involve short term discomfort but are often deemed necessary to avoid other welfare concerns such as fly strike and inbreeding.

Castration reduces the risk of unwanted ewe lamb pregnancies, ram lamb fighting and meat taint, and facilitates store lamb management. But keeping ram lambs entire encourages rapid growth and finishing, reducing the days to slaughter. Testosterone drives lean meat yield, which is desired by some consumers, but ram lambs can fail to meet desired market specification if grass quality is low.

There is no single answer for all types of flocks, but some systems may conduct less tail docking and castration in the future, or look to new technologies to reduce pain. Ongoing investigation of meat taint will also aid future decisions (by farmers and retailers) while answers may also be found through selective breeding for shorter tail length, natural shedding of wool and reduced faecal soiling.

## Reputation

The national and global reputation of UK sheep farming, particularly around the care of livestock, is increasingly important and fundamental to a good public image based on free range and extensive farming methods. Through the involvement of veterinary professionals, routine health screening, government incentives and industry groups sharing best practice, the objective is to reduce disease – which will positively impact animal performance and therefore reduce the carbon footprint of sheep production.

# CHAPTER 3.6

## Positive attributes: Rural economies, communities and infrastructure

For centuries the traditional stratified system of the UK sheep industry has played to the strengths and weaknesses of UK agricultural land.

The hills are an integral part, producing crossbred breeding replacements from hardy ewes for the lowland sector, plus store and finished lambs and also wool. The foundation of the stratified system is based in disadvantaged and less favoured areas where grassland productivity is poorer, yet hardy native sheep breeds are adept at converting grass into meat and fibre as well as valuable breeding animals.

Around half the UK sheep sector works within the stratified system, because it utilises land often unsuitable for cropping or other forms of food production and contributes a host of public goods.

In remote areas of the UK, livestock farming is a key driver for business activity and the rural economy. Sheep farming also generates a specific interaction between people and a place, important to the cultural heritage, stewardship and community, with farming providing the backbone and contributing to the social fabric and economies of those areas.

Sheep farms require services, creating a bedrock of local facilities and activities valuable for locals and visitors, all supporting the community they are set in. Sheep farming also keeps people living and working in these areas, creating need for additional jobs. Farmers often participate in other areas of employment and societal roles – such as parish councillors or organisers of local shows – leading to the development of cultural and community traditions. There are usually strong ancestral links to the area, with farmers viewing themselves as custodians of the land and bringing about a wealth of culture, history and a sense of responsibility.

## CASE STUDY: Will Rawling



**1,100 purebred Herdwicks plus composite ewes and suckler cows on 1,200 acres of unfenced Lakeland fell in Cumbria**

*Will Rawling's Lake District farm is as close to nature as possible with management practices developed to be sustainable as part of Higher Level Stewardship, including 30 acres of butterfly habitat.*

*He has seen reduced costs without compromising production, with his son managing the land to grow good grass without using chemicals. With a family history of fell farming stretching back 500 years, the family uses the traditional hefting system with the sheep on the fells. Will said the difficulties come from government (and Natural England) policies, which are well meaning but inappropriate for their area.*

*"Striking a balance between traditional practices that have underpinned all Lake District farms and delivering for nature while at the same time producing food as a commercial product is not always easy to fit into current schemes," he says.*

*Will believes there should be a dedicated free land manager adviser service for all the different areas of sustainable farming.*

Government-funded schemes have been the predominant income base for many sheep farmers in the uplands but, with payment schemes now leaning towards reward for provision of public goods, there are opportunities to review income streams while improving sheep production.

Maintaining sheep in less favoured areas keeps traditional skills alive and offers entry routes for new entrants, with ongoing capital expenditure relatively low after breeding stock purchases. Interest-free loans for new start-ups, mentoring schemes, improved broadband services and facilitation groups to encourage collaboration and avoid isolation could all aid in this area.

In an isolated profession, living in remote locations can increase this struggle. Social isolation is one of the challenges facing rural communities, with





mental health being one of the largest issues facing agriculture. Livestock auction marts are one of the remaining spaces where producers can guarantee consistent social interaction and to experience community, both determinants proven to improve physical and mental health, as well as offer a range of business activities.

Sheep farming underpins the creation and maintenance of public access, not least through roads and paths, but because sheep grazing contributes to ecology and biodiversity, increases available pasture and reduces opportunities for bracken, molinia and coarse vegetation that restricts public access.

The UK is home to more than 60 native breeds of sheep, which over centuries have been purposely adapted to often harsh conditions to best utilise native forage. These breeds all have their own characteristics and suitability for the UK's varied landscapes, often originating from a very specific part of the country.

Some of these breeds are harnessing the British Heritage Sheep scheme, focusing on the animal's age, breed and the landscape it was reared in to sell a story, opening new avenues for direct selling or niche markets, and a market for sheep that do not match the standard market specification. This approach supports economic growth and new interest in sheep meat.

As well as advantages, tourism can also bring challenges to farming communities and fragile landscapes, causing problems such as blocked gateways, increased traffic congestion, litter, risk of fires and sheep worrying by dogs, all regularly reported within UK national parks. Tourism honeypots can also lead to increased cost of local goods, inflated house prices and additional planning restrictions on building, development and even sustainable energy projects – leading to questions about the purpose of national parks.

## CASE STUDY: Neil Cole and daughter Ida

### 2,000 ewes plus suckler cows and Dartmoor ponies on 2,000 acres of Dartmoor hill in Devon

*Neil is keen to promote the important role farmers play in sustainability and environmental preservation, based on the experience of farming with his brother and now also his daughter over three sites in the Dartmoor National Park.*

*They took a business decision to farm less intensively, due to the restricted productivity of the high ground on the family farm, and are now involved in specific bird-related projects, as well as other systems to preserve the landscape via environmental schemes.*

*"When we began with the wader bird project it made us think we need to promote the good we do for wildlife, while producing the food the consumer wants and being realistic about the problems," Neil says, adding that they also offered their farm for a curlew project supported by King Charles.*

*"Our major challenge is the public. They don't realise their effect on ground nesting birds with their presence, waste and dogs in nesting areas," he says.*

*"We are producing quality breeding ewes to transfer through the stratified sheep system to the lower land, while also producing high quality food and delivering for the environment. HRH King Charles always appears extremely passionate about supporting British farmers and the nature gains they are delivering."*



## CHAPTER 3.7

### Positive attributes: High quality protein and fibre

Livestock systems are often criticised for using crops or arable land that could instead be used for human food, with the supposition that feeding livestock to produce milk or meat is less efficient than producing crops humans can eat.

Although this argument is valid for systems in which most of the feed ingredients are edible by humans, such as grains and protein crops, it does not account for a major advantage of ruminant systems – producing high quality protein from cellulose-rich forage crops (often produced on land that cannot grow anything else) and byproducts humans cannot or will not eat.

Lean red meats such as lamb and mutton are an excellent source of high biological value protein, B vitamins, minerals and omega-3 polyunsaturated fatty acids. Per 100g serving, lamb can provide around 40% of the daily recommended intake for protein, 12% long-chain omega-3, 65% vitamin B12, 17% vitamin B2, 12% iron and 25% zinc.

Yet lamb consumption per capita remains low compared to beef and pork, and very low compared to poultry. Reasons for the decline in lamb consumption in the UK include affordability, a perceived lack of convenience options, perceptions around preparation time, dietary and food consumption trends, concerns over quality and consistency, and concerns over environmental impacts. Yet diversity in sheep meat should be embraced alongside the multifunctionality of other sheep products available.

At the same time as producing high quality protein, sheep also grow wool – a naturally renewable and sustainably produced product currently undervalued and its use underdeveloped.

Most farmers now consider wool an inconvenience, given its low value contributes very little to profit. Shearing is now more commonly done for animal welfare than income. Flocks of naturally wool-shedding sheep are increasing and, if more farmers move in this direction, the long-term supply of wool will be threatened.

Wool grows naturally on sheep and is a stable form of sequestered carbon. Around half the organic matter of the fleece is carbon. There is renewed interest in promoting the use of natural fibres in traditional and innovative applications, utilising wool for its sustainable, renewable, hard wearing, fire resistant, biodegradable and versatile properties. Natural fibres do have an environmental impact, but this tends to be less harmful compared to synthetic fibres derived from limited petroleum resources that are non-biodegradable. The true cost of synthetic fabrics is not accounted for in

## CASE STUDY: Susie Parish

### Producing top quality wool from a 500-head Gotland flock in Hampshire



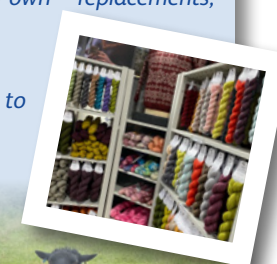
*Creating world class knitting yarns from a low input system while investing in the landscape, biodiversity and welfare is being achieved by flock manager Susie Parish on Neil and Emma Boyles' farm in Hampshire.*

*"When we started on this journey we received criticism from people saying it was just a hobby, but we have shown there is potential to make money and in some cases more money from wool than from producing commercial lambs," explains Susie.*

*"There is a mindset among many farmers that wool is just a byproduct but this must be changed. It's the ultimate sustainable fibre and great for capturing carbon," she adds.*

*The 500 Gotland sheep are all farmed with wool and skins as the main focus with meat being a byproduct. All processing (apart from scouring of the wool) takes place on-farm including spinning. The yarn is sold globally. Only a portion of the flock lambs each year, just enough to breed their own replacements, and Susie allows lambs to wean naturally.*

*"Because our focus is wool, the flock is not under any pressure and I don't need lambs to grow fast," she adds.*



its relatively cheap market value and this significantly disadvantages the use of wool in clothing, carpets and insulation is significantly disadvantaged by this.

Wool production uses chemicals (on-farm and in post-shearing cleaning and processing), energy and water, emits greenhouse gas emissions, generates waste and uses land and other resources. Nevertheless, there is growing opportunity for wool to play a key role in improving sustainability, protecting natural resources and encouraging circular economies.

In addition to increasing the use of wool in the apparel and textiles industries, there is increasing interest in and need for new and innovative applications like wool packaging, bedding, building materials, thermal and acoustic insulation, compost, lanolin use in cosmetics, water filtration and flood defences, oil spills, peatland restoration and as a plant growing substrate.



# CHAPTER 4

## Measuring sustainability

Although UK agriculture contributes relatively little to total global greenhouse gas emissions, it contributes significantly to the UK total. With UK net zero targets legislated, doing nothing is not an option.

The aim of net zero is to reduce emissions to as close to zero as possible, with any remaining emissions absorbed through natural carbon sinks - particularly relevant in grazed ruminant livestock systems where methane emissions are part of a carbon cycle including absorption (sequestration) of carbon back into soils and vegetation.

Greenhouse gases all contribute to global warming, but they differ in how long they remain in the atmosphere and how powerful the warming effect is. Using a standard measure of carbon dioxide equivalent (CO<sub>2</sub>e) makes comparison between emissions easier.

Global warming potential (GWP) is used to standardise the impact of different greenhouse gases on atmospheric warming compared to carbon dioxide. There are two ways to represent global warming potential - GWP\* or GWP<sub>100</sub>.

GWP<sub>100</sub> method does not reflect the different nature of methane compared to carbon dioxide and nitrous oxide. Methane decomposes in the atmosphere through a natural reaction, whereas carbon dioxide needs to be directly removed, meaning the atmospheric lifetime of the gases are very different – 10-20 years for methane compared to thousands of years for carbon dioxide.

### GWP\* VS GWP<sub>100</sub>

GWP\* aims to model the impact of methane better and compare the warming effect it has relative to carbon dioxide over time, known as carbon dioxide warming equivalents. Under GWP\*, methane emissions initially have a more potent impact than under GWP<sub>100</sub>, but due to its shorter atmospheric life and that it does not accumulate in the same way as carbon dioxide or nitrous oxide, it drops to having a significantly lesser impact, well below that from GWP<sub>100</sub>. Discrepancy between these two measures has created concern and confusion when trying to understand farm carbon audits.



## Methane output

Enteric methane is a natural byproduct generated when microbes inside sheep ferment forage. Methane emissions can also come from manure storage – although funding for small scale on-farm anaerobic digestors could help reduce methane loss, turning waste into resource.

Feed intake, feed quality and feed conversion efficiency all affect methane output from individual sheep. Increasing production efficiency across enterprises through genetics and management should reduce methane emissions per kg of output - also known as emissions intensity - but care needs to be taken in chasing methane reductions alone as this could have wider economic, food resilience, environmental and market implications.

Using 'kg of product' also poses difficulties as the value of livestock is misrepresented, in terms of the valuable co-products they produce. These include recycling byproducts, up-cycling non-productive land, potentially enhancing soil and biodiversity and providing social resilience platforms. They are not just a source of nutrition.

Because of the consequences GWP\* versus GWP<sub>100</sub> (see panel) have for the sheep sector, reporting metrics together is highly beneficial to provide a clearer picture. Comparing carbon dioxide equivalent per unit of recommended daily intake of key nutrients provided and including the carbon reduction and removal capacity of the farm – through soil, vegetation growth hedgerows and trees, the potential for green energy production and reducing fossil fuel emissions – should also be considered to more accurately represent net zero or even negative greenhouse gas emissions.

Including true and accurate land use potential is difficult but important for metrics. If sheep are raised on land not suitable for growing crops, or use food-industry waste-streams as part of a multifunctional system and circular economy, the output of human edible food is considerably greater than the input of human edible food used as livestock feed. This is why a single metric will never do justice to the complexity and multifunctionality of different sheep production systems.

Food system stakeholders and the media often focus on ruminant livestock as the cause of climate change and call for meat consumption and livestock numbers to be reduced. This myopic view fails to account for the wider benefits of sheep systems for soil health, biodiversity, food security and rural social cohesion, or the role of grazing livestock in sequestering carbon into soil. Reducing fossil-fuel powered travel and increasing building energy efficiency both have more potential benefit than adopting a plant-based diet.

Nevertheless, there is an urgent need to measure, benchmark and improve greenhouse gas emissions from every UK operation.

## Carbon auditing tools

Adoption of carbon audits and auditing tools as useful management tools is increasing – but uptake is low in smaller, private farm businesses due to a lack of understanding, variation in calculation tools and lack of incentives and direction within UK farming policy.

Commercial carbon footprinting tools have been developed independently with no set standards for information going in, formulas used or the resulting reports. They are valuable for assessing a farm and monitoring improvement, providing the same tool is used, but don't help in collating supply chain data or generating a national picture.

Securing consistent and valuable data, can only be achieved by using one tool, or agreeing standardised metrics and approaches across tools. Confidence and uptake will increase as consistency improves and standardised baseline and user-friendly platforms continue to be developed. The situation is progressing, but there is still too much variation in how much farm information must be entered and whether or not they can provide results-based recommendations on how to improve. Accurate assessments of carbon sequestration into soil and held by vegetation are also essential in any carbon footprinting tool used on sheep farms, as is the use of metric GWP\*.

Despite the current challenges, the existing tools are useful and waiting until a standardised tool is developed risks losing information on gains made over time. It is right for individual flocks to act now in picking a tool that fits their level of data entry and time available. Even if it becomes necessary to swap tools in the future, this does not outweigh the benefits of establishing a baseline now, especially if you can access funding to cover the cost.



## CASE STUDY: Ed Brant

**500 ewes and 150 ewe lambs on a 1,480-acre lowland beef and sheep farm in Lincolnshire**

*Ed is committed to improving his flock by employing a detailed scanning and data collection system to optimise breeding and output levels.*

*He says: "We use performance recording to select and breed our own rams. We also record data when handling and treating animals and base treatments on weight and performance, using this to aid future breeding decisions."*

*The level of information being gathered on farm has grown from pedigree information and two weights per lamb, to scanning for muscle depth, CT scanning for potential terminal rams, measurements for parasite resistance and weighing lambs every time they are treated.*

*Ed continues: "We started with a small pedigree flock where all the information was recorded. As the flock grew, we have seen the benefit of improving genetics and tracking performance."*

*The farm has seen improved growth rates in lambs and better milking, prolificacy and mothering ability in ewes. It has also become easier to identify poorly performing ewes.*

*Challenges include the time taken for data collection and single sire mating, meaning more work at tugging. For any farmers thinking of doing more with data, Ed suggests: "Start collecting a bit of sample information, using it to gain the most value, before asking what do I need to know next to make better decisions in the future."*





Funding, on-farm training and support, particularly for businesses run by a single person, should be more of a priority. This includes utilising and understanding the results once the tool has been used. Given the close relationship between farm efficiency and greenhouse gas emissions, many practices that improve economic viability will also reduce greenhouse gas emissions, yet deciding which aspects of production to improve may be less clear-cut.

The aim must be to minimise trade-offs between carbon footprints, biodiversity, soil health, water use and other metrics and make evidence-based decisions based on clear on-farm sustainability goals. To put it simply for producers - ascertain where the farm business is (baseline), where you'd like to be (on-farm sustainability goals) and the best method of getting there, using accurate data.

The huge variation in sheep systems, including some flocks that sell lambs before they reach finishing weights and the flocks that buy those store lambs, means consideration must be given to the specific system to ensure disproportionate carbon burdens are not calculated. Research is needed to assess the impact of carrying forward footprints when animals move between farms.

At a national level, the industry needs a robust scientific baseline looking at agriculture as part of a wider ecosystem that includes activities such as tree and hedgerow planting and renewable energy generation. Any record keeping must be founded on consistent and science based metrics across industries and appropriate metrics across upland, lowland and mixed farming scenarios. To improve record keeping, farmers and land managers need to understand the basics of the metrics being recorded and to be encouraged to embrace them through confidence that data collection and analysis will be simple, streamlined and harmonised.

## CASE STUDY: Richard Oglesby

**1,600 ewes plus suckler cows and red deer hinds within a 1,450-acre upland contract farming business in Northumberland**

*Grassland management and genetics are the two biggest drivers of success for Richard.*

*He says: "Our view is that sustainability and profitability go hand in hand on-farm, especially with the new environmental schemes. We have received increased income from the new schemes while also providing more biodiversity. Rotational grazing benefits the farm by increased stocking rates, reduced fertiliser and bought in feed, and increased carbon sequestration."*

*The focus is on rotating sheep and cattle at the right time and saving paddocks for winter grazing. Richard says genetics play a huge part and the system would not work without the correct livestock breeds.*

*"Ewes need to lamb outside unassisted and put on good body condition over the summer and maintain it. Lambs need to be able to achieve adequate weight gain from grass and ewe lambs need to achieve 40kg by late November so they can be tupped," explains Richard.*

*He believes the government could do more to incentivise improved genetics and performance recording on farms, enabling uptake of DNA testing lambs to overcome the challenge of single sire mating.*



## CHAPTER 5

### Future progress: the challenges and solutions

The agricultural industry is unique in being a contributor to greenhouse gas emissions and, through acting as a carbon sink, also being a climate change mitigator. This gives farmers the dual challenge and opportunity to reduce emissions and maintain food production, while also increasing carbon sequestration.

This raises pressing questions around viable markets; finance for delivery of public goods; food security; self-sufficiency and sovereignty; healthy diets; climate change; nature loss; soil, air and water quality; biodiversity; and the health and welfare of farmed animals.

Most UK sheep farmers have a strong and positive interest in the environment but policies and attitudes have polarised environmental management and food production. Recognition of the equal importance of both can be achieved through policymakers accepting the answer is not land sharing or land sparing, but instead recognising there should be a balance depending on resources and objectives. Even on extensive sheep enterprises where land sharing between farming and many other interests is commonplace, some land will be spared for hedgerows, trees or wetlands.

Farmers must be central to decision-making. They manage 71% of Britain's land area and need frameworks that are flexible and enable choice in delivering environmental protection while ensuring food production and UK food security are not overlooked.

It needs to be recognised that agriculture has made reductions in greenhouse gas emissions compared to other sectors but, as these sectors de-carbonise, agricultural emissions will need to be increasingly offset through land management, such as involvement in public and private agri-environment schemes.

The active farmer must be the recipient beneficiary of any scheme, using a tenants' commissioner to ensure fair play between landowners and tenants. Schemes should also continue to incentivise improvement and enhancement of on-farm biodiversity while producing food. Accepted and reliable definitions, measurements, indicators of holistic sustainability and critical baselining are also needed for assessment and reviewing of performance.

UK farmers have already shown willingness to engage in environmental improvements and the best results come when they can pick options best suited to their individual farm goals.

## CASE STUDY: Kevin Harrison

**280 wool-shedding and 160 higher input ewes on a 480-acre mixed hill farm in Gloucestershire**

*Reducing both human input, expenditure and a reliance on bought in feed was the driving force behind changes made by Kevin on the farm he manages in the Cotswolds.*

*He used to run 900 North of England Mules in an intensive feeding, early lambing system. In order to get a better work/life balance, he decided to reduce numbers, change the breed and is now embracing the easier care concept. It has led to reduced feed and labour, fertiliser, energy and medicine inputs.*

*"My mental and physical wellbeing has improved, as the physical strain of weighing lambs every week and filling feeders was huge," he says. Kevin only began the transition process last year but is hoping to eventually have a closed flock of 550 Exlanas with minimal input and the ability to take on environmental schemes due to the new sheep management system.*

*"It requires a completely different understanding of parasites, timing of treatments, understanding SCOPS from a grazing perspective versus indoor, and getting a handle on the opportunities and challenges of year-round grazing," says Kevin.*

*Kevin is aware the farm is contributing less to food security but would value a holistic sustainability tool to allow him to better understand the outputs of the farm.*



## Policy

Governments must provide a clear vision, long-term direction and invest adequately in programmes that improve sheep farming efficiency, reduce environmental impacts, and provide an encouraging landscape for current and future farming generations with agricultural and environmental strategies that go beyond parliamentary terms. Policies should do more to be ahead of future challenges, requiring partnerships and consensus around future trade policy.

Reconciling and balancing views on national and global food security and self-sufficiency is needed. Food, farming, environment, health and education policy direction would also benefit from being more aligned to avoid contradictions. Improved clarity and connectivity and better information sharing in agricultural policy development across the UK administrations would level the playing field and provide strategic direction in tackling challenges.

Sheep farmers want the opportunity for informed discussion with decisionmakers, ensuring the aims and



implementation of future agricultural policy are relevant, evidence based and applicable. This would make use of their knowledge and experience in using best delivery methods alongside food production. They should also be involved in testing and trialling schemes before wider rollout.

Significant changes to land management must be pragmatic and practical for farmers, recognising they can become stronger stakeholders and benefit financially.

Food production and food security in the UK should not come at the cost of other industries offsetting their emissions. Carbon trading is in its early stages but should not create conflict between landowners, tenants, owners of commons and rights holders. Farmers should be careful not to sell off carbon rights – particularly given that the current mechanisms around carbon auditing, offsetting and trading are inconsistent and uncertain, with an absence of accreditation standards.

Policymakers should recognise the potential pitfalls and disruptions caused by developing carbon offsetting and nature markets and consider measures to safeguard existing land management arrangements. With such a high proportion of UK farmland being rented (45% of farms in England are tenanted or a mixture of owned and tenanted), the recommendations of the 2022 Rock Review should be implemented in full.

## Food security

The diversity of UK sheep breeds and farming systems should be embraced and supported. A livestock gene bank with a dynamic inclusion storage strategy is needed to preserve genetics that could be of value and protect against genetic loss in the event of a major disease outbreak. We need recognition of the value of diversity, including agricultural genetics. This diversity should be encouraged via policy but also supported via market development at a strategic level.

Food security may be best achieved by being part of a global food system, but must be underpinned by a high level of food self-sufficiency to protect against a volatile world where politics, economics and climate can easily and quickly change. The covid pandemic and ongoing conflicts in Ukraine and Gaza highlight the vulnerability of UK food security if governments continue to prioritise imports and not support domestic production.

There is a critical need for UK produce (world-renowned for its high environmental, welfare and health standards) to be at the heart of any future food, trade, health and environmental policy to ensure UK food security. The industry needs debated targets for trade balance in sheep meat, imports to be of equivalent standards and measures available to avoid market disruption.

While the focus should rightly be on environmentally friendly food production and reducing food waste, the increasing world population will drive up demand. In

## CASE STUDY: John Yeomans

**540 breeding ewes and 180 ewe lambs plus sucker cows on 275 acres of hill in Powys**

*Making the farming pay to allow conservation work to continue is important to John, his wife Sarah and children Tom, Jack and Joe.*

*“Over the years we have planted more than 40,000 hedge and tree plants and renovated and planted new hedges. We believe productive farming and conservation work go hand in hand,” says John.*

*The family is constantly trying to improve the farm in all ways – leys for their sheep to improve grazing, looking at different seeds mixtures, carbon capture, optimising production, best practice parasite control, lamb and beef boxes sold off farm and using a solar water pump on one hill block to aid grazing.*

*“We started rotational grazing in 2014 after the dreadful spring of 2013. That has had quite an impact on our farming, but of course it is certainly not for everyone,” says John.*



the UK, the prioritisation of environmental outcomes/preservation of natural resources over food production, and the response of farmers to low-risk environmental schemes compared to producing food in an uncertain climate for volatile markets, will drive down production.

This is why policies should not undermine sustainable food and why both production and food security should be recognised and incentivised as public goods, at a level that does not remove farmers from the reality of the market.

If we produce less food, it puts the country at risk of becoming reliant on imported food often with a higher carbon footprint and lower welfare standards. With increasing living costs already affecting diets, utilising homegrown produce is central to being a more food secure nation.

This brings us back to the needs for holistic assessments and an interconnected land use, environmental, and food production vision with targets and goals. Reducing livestock numbers as a quick fix for methane emissions will reduce production capacity and result in the UK being less food secure and more reliant on imports over which we have little influence. It would also result in a



great disconnect between society and food production and value, creating national risks with climate related disruption, resource availability, food access and political unrest. The UK should aspire to increase food self-sufficiency levels within environmental boundaries, increasing productivity and minimising loss and waste.

## Market support

Provenance is a key selling point for UK lamb exports and supports the ambition to eat less meat but better quality. More could be done domestically, such as via the British Heritage Sheep project, to sell the sustainable, natural story of sheep meat, to increase product differentiation, appeal to a younger generation of consumers and make a virtue of diversity, flavours and taste experiences.

Support to raise awareness, increase consumer value of provenance, dispel cooking myths and encourage more access opportunities to embrace sector diversity would boost domestic sales and provide a point of interest in some of our export markets. AHDB data suggests our export trade is so effective it upholds the value of every lamb sold by £40. This highlights the need to invest more in export development through overseas trade development posts. Also that effective planning and strategic thinking is put into UK sheep farmers supplying public procurement markets.

More support for specialist products and shorter supply chains (reduced food miles) would also help deliver value for sheep meat products with high levels of provenance. Overall, more investment in market development and proper financial reward for index-linked public goods delivery is needed, recognising the strength of a broad range of market opportunities including supermarkets, high streets butchers, farm shops, halal and export markets.

## Attitude and adoption

Farmers frequently demonstrate an aptitude for innovation but adoption of appropriate technology and new management approaches can be slower than the pace of change. An unwillingness to change acts as a barrier, so regular communication and contact with others is needed to encourage strong, credible and reliable relationships.

Instead of dividing food production from environmental protection, it is important to accept that sheep farming is a multifunctional activity and there are varying ways of balancing production with environmental and landscape management.

Encouraging and incentivising on-farm technology adoption should ideally be farmer-led, with training opportunities to demonstrate the benefits on profitability, productivity, efficiency, animal health and wider sustainability. Knowledge exchange on its own does not lead to successful adoption. There is a need

for consistency, follow-up and on-going support for successful and continued application.

Technologies such as regular faecal egg counts, better use of electronic ID and livestock information services, disease screening and health monitoring programmes, and the use of current and new vaccines are already being deployed, making flocks efficient and productive, reducing greenhouse gas emissions, and contributing to global One Health commitments.

Further government investment in drone, satellite and remote sensing technology; vaccine development and licensing; improved disease/parasite screening tools; food traceability alongside innovation; and government support including knowledge exchange, would aid understanding and further adoption. Uptake should increase and efficiency improve if technologies become more affordable, cost-efficient and simple to use.

Awareness, education and ownership of the challenges and the solutions is key and must be prioritised and integrated into new schemes.

## A SNAPSHOT OF ACHIEVEMENTS SO FAR

### Highlights of the Sustainable Farming Incentive (England) 2021-2023

- ✓ Projects covering 40,000ha including those to restore and protect 700km of rivers to provide habitats for 263 species including water vole, otter, pine marten, lapwing, great crested newt, European eel and marsh fritillary.
- ✓ 32,000 Countryside Stewardship agreements, a 94% increase from 2020.
- ✓ 46% of 2,307,258ha mapped priority habitats in agri-environment or woodland scheme. Building on the 2021 Farming in Protected Landscapes Scheme that created and improved more than 70,000ha of habitat for biodiversity, planted more than 100 miles of hedgerow and more than 100,000 trees, restored eight miles or drystone walling, and conserved or enhanced 300 historic features, buildings and structures.





# REPORT CONCLUSION

While people actually make things happen, government policies arguably have the biggest impact on farming and land use.

Britain's exit from the EU presented the opportunity for new policies to support environmental, social and food needs, but it took serious disruption in food supply chains during the covid pandemic and the conflicts in Ukraine and Gaza for policymakers to wake up to the fragility of our food security and availability.

The frailty of an approach putting environment into a public funded box and leaving food to the vagaries of an increasingly global marketplace must now be acknowledged. Agricultural policy needs to be long term, provide stability and clear direction with the ability to fine tune policies quickly, recognising the multiple challenges but accepting the interconnectedness of a healthy planet, healthy ecosystems and healthy people.

## NSA key asks: Delivery

- Clear scheme and policy objectives, with truthful, honest and in-depth monitoring of outcomes and broad sustainability metrics.
- Pre-rollout testing, monitoring and evaluation of new land management schemes and any system that places financial value on carbon credits and biodiversity.
- Environment work at a scale and with operational procedures that encourage delivery by farmers and local contractors, supporting local rural economies.
- Farm schemes to cover carbon footprinting and sustainability assessment costs.
- Farm schemes to include capture of core data, with investment to enable it to be utilised nationally in an anonymised/aggregated way.
- Incentives and encouragement for wider uptake of health monitoring schemes.
- Legislative changes to permit proven technology and tools to reduce pain at castration and tailing.
- Support for adoption of UK wide health and disease strategies.
- Recognition of the value of the Register of Sheep Advisers (RoSA) in advice provision.

## NSA key asks: Strategic and directional

- A clear long term vision and strategic direction for UK agriculture, food and land use, including species introductions, at a national and local level, within broad sustainability targets and with agreed goals and adequate funding.
- Food production to be recognised as being of national strategic importance and accepted as a public good.
- Sheep meat imports required to be of an equivalent standard, to raise global sustainability outcomes.
- Within existing trade deals, measures to avoid market disruption to be tested and then employed when needed.
- Exploration of a new Sanitary & Phytosanitary Health Agreement with the EU, to aid EU trade and reduce disease risk from illegal imports.
- Recognition of potential trade-offs between various sustainability objectives and a move towards simple but broad sustainability assessments.
- Replication of the independently chaired Land Use Group as recommended in the Dartmoor Review for other sensitive and contested areas.
- A review into the strategic importance of UK vaccine production and the risks to health, welfare, food production and carbon footprints of unreliable vaccine supply.
- Commitment to ongoing financial incentives to maintain and further improve health and welfare of farmed animals.
- A focused review of carbon sequestration opportunities presented by sensitive farming and related cropped and non-cropped habitats.



This report demonstrates the importance of holistic thinking and recognising multifunctionality, valuing what we have and enabling us to highlight strengths, weaknesses and acceptable trade-offs, that vary between regions, counties and farms.

Sheep farming has been criticised for being non progressive, failing to make the technical progress observed in other livestock sectors. This report identifies clear challenges, but the sector has been right to resist calls to reduce genetic diversity or intensify beyond on-farm resources. As an industry, we have been right to maintain our free range and grass-based systems and to persist through tough economic times.

The UK approach to farming sheep aligns with regenerative interests both in the uplands and lowlands. Sheep are free to enjoy a life close to nature; farmers are focusing on reducing inputs and striving for responsible medicine use; and management practices aim to build soils and sequester carbon while reducing emissions and delivering for the environment. Most sheep farmers are involved in ways to improve their systems, through a combination of genetics, nutrition and health, reducing waste and adding value.

But for all the positives we still have a long way to go. We need to encourage adoption of good practice and efficiency measures, and the use of basic records providing data to support evidence-based decisions. There is more we must do to reduce energy use, methane emissions and carbon footprints. There are many opportunities to make more space for nature and improve water quality. Our ecosystems are best supported from the ground up and while there is talk of reintroducing apex predators around the country, this would only work with a clear mitigation strategy. There are plenty of non-contentious species we can support.

We need schemes that encourage profitable and resilient food production to be at the core of sustainable land management, providing and encouraging investment in true sustainability. Schemes that support small and medium scale processing and innovation and give long term confidence in protecting the environment and supporting communities – including recognition of healthy food production as a public good. We need a better means to communicate all this and integrate with education and advice on health and wellbeing, and sometimes we need stricter regulations that enforce responsible use of the countryside.

We are blessed with intelligent and enthusiastic young people coming into our industry, many of whom are supported through the NSA Next Generation programme offering education, hands on experience and access to a wide range of expertise. Collectively, we need to shoulder responsibility to own the challenges we face, to be enthusiastic about the environment, nature and improving sheep welfare, encouraging the next generation as much as we can.

The market can play its part too. Levy bodies recognise the importance of trade development and the need

## NSA key asks: Development and innovation

- Development of a farmer decision tool to assess the impact of potential management changes and scheme involvement.
- Establishment of a national livestock gene bank with a dynamic storage strategy.
- Expansion of farm support schemes to fund whole lifecycle carbon assessments and sustainability footprinting, and also drive data recording to support performance advances.
- Development of products and markets that make a virtue of systems diversity.
- The establishment of sustainability/ environmental indicators to support breeding values.
- Harmonisation of the key metrics of carbon calculators with reporting including GWP<sub>100</sub> and GWP\* and on a per kg of output and per hectare basis.
- Development of recognised methods of sustainability assessments across a broad set of metrics.
- Appointment of a tenants' commissioner with commitment to progressing with the recommendations of the Rock Review.
- More investment in identification of reliable genetic markers for key diseases.
- Investment in small scale/non disruptive farm based renewable energy production.
- Innovation and investment in of wool.

for positive reputation and promotion of UK produce. Markets can drive improvements but we must protect our domestic market against imported alternatives not produced to our standards and values. It's incompatible to think we can operate to some of the highest regulatory requirements and have a cheap food culture.

NSA would not be doing its job responsibly, nor would we be taken seriously, if this report didn't highlight the areas where we can improve. But this report also shows UK sheep farming has a sound base to remain sustainable for the future – fantastic nutritious food, renewable fibre, and leaving in its wake an attractive environment enjoyed by all.

The facts presented are evidence based thanks to the work of the School of Sustainable Food & Farming at Harper Adams University. NSA would also like to thank all the farmers who have enthusiastically contributed case studies. As a grassroots farming organisation, no NSA publication would be complete without your help.

THE FULL VERSION OF THIS REPORT, CITING SOURCES FOR ALL THE INFORMATION INCLUDED, IS AVAILABLE AT [www.nationalsheep.org.uk/our-work/policy](http://www.nationalsheep.org.uk/our-work/policy)





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