



THE COMPLEMENTARY ROLE OF SHEEP IN UPLAND AND HILL AREAS

THE FULL REPORT, WITH REFERENCES, TO SUPPORT THE SUMMARY DOCUMENT PUBLISHED BY NSA.





EXECUTIVE SUMMARY 02

1.0 INTRODUCTION 03

2.0 ECONOMIC OUTPUTS 04

 2.1 Food 05

 2.2 Genetics 06

 2.3 Wool and skins 08

 2.4 Niche markets 10

 2.5 Public goods 12

3.0 ENVIRONMENTAL LINKS AND OUTPUTS 15

 3.1 Water management & flood alleviation 16

 3.2 Carbon & peat 17

 3.3 Heather & bracken 19

 3.4 Biodiversity & other species 20

 3.5 Woodland 22

 3.6 Semi-natural habitats 23

4.0 SOCIETAL LINKS AND OUTCOMES 25

 4.1 Tourism & recreation 26

 4.2 Culture & heritage 28

 4.3 Common land & crofting 30

 4.4 Sheep management skills 32

 4.5 Opportunities for new entrants 34

5.0 CONCLUSION 36

 5.1 Economic outputs 36

 5.2 Environmental links and outputs 36

 5.3 Societal links and outcomes 36

 5.4 Summary of aspirations 37

REFERENCES 38

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The 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.

The purpose of this report is to update the NSA report on *the Complementary role of sheep in Less Favoured Areas*, which was produced in 2012. Like the first paper, this updated report looks at the wide range of public goods and services provided by sheep farming businesses in the hills and upland areas of the UK. NSA considers these to fall into three pillars of sustainability – economic outputs, environmental benefits and societal links. All the benefits within these pillars, be they food production, local economies, landscape management, cultural heritage or environmental stewardship, are enjoyed by everyone from rural communities through to international consumers and tourists. NSA believes there has been some increase in recognition of these benefits since the first report. However, there is still a long way to go and steps must be taken to ensure the irreplaceable activity of sheep farming in these areas is preserved and enhanced.

It is positive that interest in sheep farming from the general public has increased since the first report, linked in no small way to a number of high profile television programmes such as *This Farming Life* and bestselling books such as *The Shepherd's Life*. There has been acknowledgment in some quarters that sheep are an important part of the jigsaw in upland areas, and that agri-environment and conservation schemes have sometimes forced stocking rates too low, unintentionally damaging biodiversity. There have also been some backwards steps in terms of the misinformed debate over rewilding and links between sheep and flooding.

The recent referendum decision to take us out of the European Union has dramatically changed the political landscape. Discussions over land classification and support payments for public goods in our four nations have not yet been resolved since the most recent reform of the EU's Common Agricultural Policy (CAP), and we must learn from the past as we create a new UK agricultural policy. This policy must give special consideration to the hills and uplands and the unique combination of public goods faring these areas provide. There has never been a more important time to understand the tri-fold contribution of economic, environment and societal benefits. Within these pages, NSA considers these three pillars of sheep farming in upland and hill areas and lists a number of aspirations for the sector.



1.0 INTRODUCTION

The uplands and hills of Britain are an integral part of the sheep industry, producing breeding stock for lowland enterprises, store lambs, finished lambs and wool. Traditionally an integral part of the stratified sheep industry, and home to some of our hardest native breeds, farming in these areas is now recognised as a multifunctional activity, providing more than just agricultural outputs. These are important areas of biodiversity and ecological processes, as well as being vital in sustaining rural communities.

NSA is concerned that upland and hill farms continually come under threat due to ever changing market, social and policy pressures. These influence and risk fundamental change to the farming system itself, often ignoring the value that this most traditional and essential form of livestock farming provide. Over the years, upland and hill farmers have been at the mercy of policy makers, increasing livestock numbers when headage payments were introduced to incentivise productivity gains, and then reducing stocking rates when environmental impact concerns came to the fore, despite overly prescriptive requirements often being detrimental and leading to undesirable agronomic, environmental and societal impacts.

This report is split into three sections, economics, environment and society, which NSA considers to be the three pillars of sustainability in this sector. This is supported by the International Convention of Biological Diversity acknowledging that 'substantial investments are required to conserve biological diversity and that there is the expectation of a broad range of environmental, economic and social benefits from these investments' (United Nations, 1992).

Although the report is aimed at the upland areas of the UK, the principles apply to other marginal areas and most of the permanent pasture. Disadvantaged types of agricultural land have been recognised by policy makers at the highest level for decades, with special attention paid to areas right across Europe that may not be as fertile as the lowlands but deliver important public goods and services over and above food production. At the time of writing this report, new EU regulations were resulting in a change in designation for this type of land, from Less Favoured Areas (LFA) to Areas of Natural Constraint (ANC). Those changes may result in quite a difference for the individual farmers, but the total designation of 9.12 million hectares of LFA in the UK (53% of the utilised agricultural area) looks likely to remain similar. The breakdown of LFA land is:-

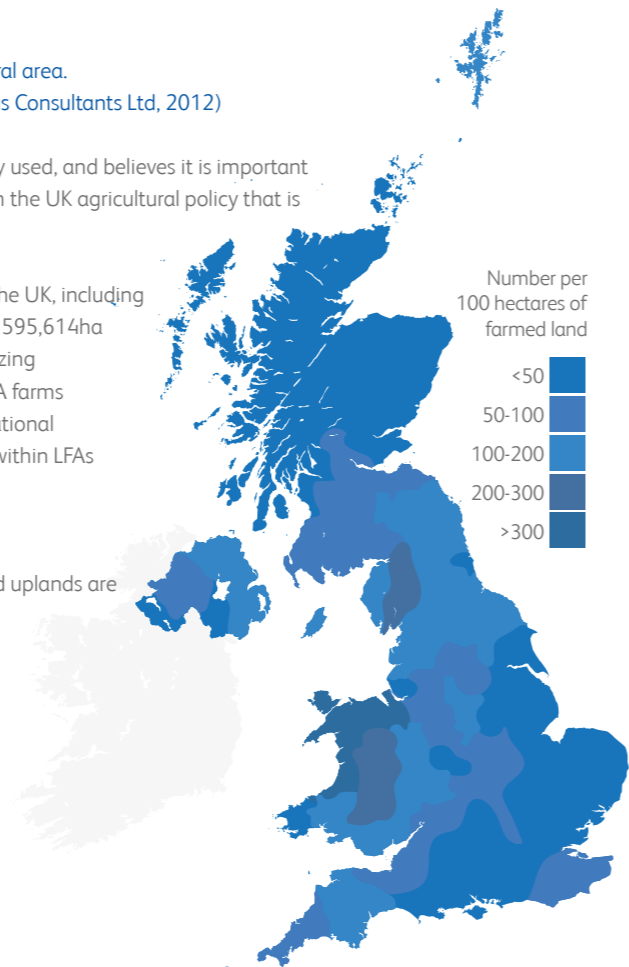
- 2.2 million hectares in England, 1.8 million hectares of which are in agricultural production; 17% of the utilised agricultural area.
- 1.53 million hectares in Wales; 80% of the utilised agricultural area.
- 5.38 million hectares in Scotland; 86% of the utilised agricultural area.
- 69,220 hectares in Northern Ireland; around 70% of the total agricultural area.

(Cumulus Consultants Ltd, 2012)

NSA fully supports land being designated in this way, regardless of the terminology used, and believes it is important to have a system that recognises disadvantaged/naturally constrained areas within the UK agricultural policy that is developed post-Brexit.

The latest available data (2014) states there are 33.7 million sheep and lambs in the UK, including 16 million breeding ewes (AHDB, 2015). In England 61% of the sheep flock utilise 595,614ha of the permanent grassland available and 35% graze 340,885ha of the rough grazing available (Marsh et al., 2012). In England 41% of breeding sheep are found on LFA farms (Harvey & Scott, 2015); 63% of cattle and sheep holdings are in LFAs in Wales (National Assembly for Wales, 2009); 80% of the sheep population in Northern Ireland are within LFAs (Farmers Weekly, 2010); and LFAs in Scotland are home to 91% of breeding ewes (Laurence Gould Partnership, 2004).

Given the land mass and number of sheep, NSA believes it is clear that the hills and uplands are a vital part of complex picture and require particular attention.



DENSITY OF UK BREEDING EWES

Source: Defra, Dardni, Scottish Government, Welsh Government. June 2013

2.0 ECONOMIC OUTPUTS

There are a wide variety of products that can be sourced from sheep meat: prime lamb remains a firm favourite for Sunday roasts and special occasions in the UK and across Europe; mince, burgers, diced lamb and lamb steaks are starting to find favour with younger consumers; quality mutton is experiencing a resurgence of interest from gastronomes; a variety of lamb and mutton products are highly sought after by ethnic populations; offal and low value cuts are popular in non-EU export markets; wool is seeing increased interest as a sustainable fibre; and Ugg boots and other quality products rely on a supply of sheep skins.

The UK is home to 25% of the EU sheep flock and 3% of the global flock, producing one third of EU sheep meat. It is the sixth biggest producer worldwide (Colby, 2015) and exports from the UK have risen with 36% of current production now going overseas (NFU & NSA, 2014). The UK finds itself in a strong position in a growing world population, having market access to 100 countries (AHDB, 2016b). The hills and uplands are an essential part of this production model, not just supplying lamb and mutton where possible, but also providing breeding stock and genetics to other sheep farming businesses in less marginal areas.

Despite this extremely positive position, the UK sheep industry still struggles for financial viability, having to compete against other cheaper meats, such as poultry and pork, and competing against global competitors in most market outlets. In addition, many of the efficiency drivers of the modern farming economy and its market structure put pressure on the traditional upland system. This means productivity gains are either not appropriate, due to land type, or are openly discouraged and disadvantaged, due to land designation and planning controls.



NSA believes upland and hill areas would benefit from:-

- Improved resources for marketing of upland lamb and other sheep products.
- Mitigation against market volatility.
- Promotion of the health benefits of predominantly grass-fed red meat to a wider audience.
- Sustainable prices for producers and consumers.

The UK produced 298,000 tonnes of sheep meat in 2014 (AHDB, 2016c). Our domestic market is hugely important and further work is required to promote the consumption of British lamb and reverse the downward trend that has been seen in recent decades. The unique range of sheep breeds and their genetic attributes, from the early lambing fast maturing lowland flocks, to the later lambing late maturing and slower growing hill flocks, means lamb can be produced all year round. The export market is also essential and the traditional demand in Europe, particularly from France, coupled with the growing global population and projections for increasing wealth in Asia, means there is further potential to develop new markets and increase demand for UK product. Access to the common market must be a priority in the Brexit negotiations between the UK and EU. At the same time, urgency is needed in negotiating trade deals with Asia, the Middle East and the USA in particular.

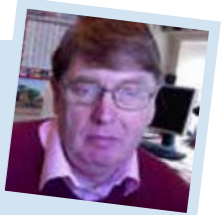
The Convention on Biological Diversity states United Nation member states must 'be aware that conservation and sustainable use of biological diversity is of critical importance for meeting the food, health and other needs of the growing world population' (United Nations, 1992). In 2015, 79,400 tonnes of UK sheep meat was exported (HCC, 2016) with more than 50% (42,700 tonnes) going to France (Colby, 2015). An export destination of particular interest for purebred hill and upland breeds is southern Europe, where light lambs have been traditionally sought after when their own supply is depleted by dry summers and disease outbreaks (Federation of Cumbria Commoners, 2011a). The economic downturn has seen this market fall in recent years, and the structure of EU exports will change over the coming years, but significant growth has been made in the export of fifth quarter sheep cuts (offal) to non-EU destinations such as South Africa and the Ivory Coast (AHDB, 2016b). Priorities for additional export certificates include China, which is the largest global producer and consumer and would drive demand for cheaper cuts not found in the domestic market (Colby, 2015), and also the USA, which has scope to be an important market for prime lamb cuts (Colby, 2015). The lack of progress made by the EU in negotiating Free Trade Agreements (FTAs) had put UK exporters at a competitive disadvantage for non-EU markets wanting lower-value cuts (Colby, 2015) but the ability of the UK to do this independently, outside the EU, is not yet known. Currently Australia and New Zealand are leading the way in this area. The UK is an importer of lamb as well as an exporter, and the New Zealand quota for imports into the EU will also be under review and the UK prepares to leave the EU. It could be hugely advantageous to the UK to review this quota and have a trade deal that complements our domestic production far more than it does currently, and to take opportunities to ensure importing nations do not undermine UK production with lower regulatory requirements.

Red meat has been shown to be extremely beneficial to health, by providing a variety of benefits such as improved immune function, a healthy heart, red blood cell formation and growth (AHDB, 2016a). Plant-based food has to be highly refined in order to be suitable for adequate human consumption, involving chemicals and energy (Watson, 2015), and we would have to consume 25% more in order to compensate for the loss of nutrients in solely vegetarian diets (Watson, 2015).



THE ROLE OF RED MEAT IN HUMAN HEALTH

Richard Young, Sustainable Food Trust, says: "We humans have evolved over tens of thousands of years as red meat eaters. As such, natural selection has adapted us to eat and thrive on meat as well as plants. Our combination of incisors and molar teeth is a clear indication of that. Red meat from animals predominantly raised on grass contains the perfect balance of essential amino acids and essential fatty acids we all need for health. It also contains a wide range of essential minerals and antioxidants. In providing us with red meat, sheep exhale methane, which is a potent greenhouse gas. However, campaigners distort the significance of this by citing the FAO's claim that livestock are responsible for 14.5% of global warming. More than half that estimate relates to the greenhouse gas emissions associated with the destruction of virgin land and rain forest in South America more than a decade ago. For the UK the change in land use is entirely the reverse, as lowland grassland gets converted to cropland as demand for lamb declines. On average, each hectare of grassland permanently converted to cropping will release CO₂ and N₂O equivalent of 250 tonnes of CO₂ into the atmosphere over the next century, with most of this lost in the first 25 years. This also kills off the soil methane sink, which is the bacteria that use methane as their energy source, which are found in high numbers in permanent pasture. Ruminants only recycle carbon, whether exhaled as CO₂ or CH₄, as they cannot put into the atmosphere more than is taken out each year by the plants, predominantly grass, that they eat. That's very different from food production, which is heavily based on fossil fuel, because the methane lost to the atmosphere there adds new (additional) carbon."



CASE STUDY

Sheep reared in hill and upland areas spend the majority of time, if not all of it, outside at grass. Consumption of grass-fed red meat in line with recommended levels is important for reducing the risk of cancer, aiding the recovery from surgery, reducing high blood pressure and reducing the risk of mental disorders, such as depression and Alzheimer's disease (Lee et al., 2013). It contains two to four times as many omega-3 fatty acids as concentrate-fed meat, as 60% of the fatty acids in grass are omega-3 (Robinson, 2015). While grass-fed diets have been shown to increase omega-3 across the board in lamb, fatty acid composition is related to the breed of sheep, feed type and rearing system, giving unique characteristics and flavours (Fisher et al, 2000). Groups fed indigenous grass or natural flora were also found to have high concentrations of 18:3-linoleic acid, another type of omega-3 fatty acid and long chain poly-unsaturated fatty acid (Fisher et al, 2000).

The average fat content of red meat has significantly reduced over the past 20 years (AHDB, 2011a) and finishing lambs on grass specifically produces a lean product (AHDB, 2010). The general public is widely unaware of this, despite 'healthiness' becoming a key quality issue for consumers (Fisher et al, 2000). Due to modern breeding programmes, feeding regimes and new butchery methods, high proportions of visible fat have been eliminated (AHDB, 2011a) and fully trimmed lean raw lamb only contains 8% fat (AHDB, 2011b). Grass-fed red meat is the richest known source of cancer-preventing conjugated linoleic acid (CLA), containing three to five times more of the trans-fat than meat from other sources (Robinson, 2015). For example, heather and moorland-fed lamb has been shown to be higher in CLA (Lee et al., 2005) while the consumption of heather, herbs and clovers provides a more interesting, fuller flavour and a finer grain of meat (Blythman, 2013). Studies have also shown that vitamin E is four times higher in grass-fed animals, and twice as high even of concentrate-fed animals supplemented with vitamin E (Robinson, 2015). Vitamin E contributes to a lower risk of cancer, as well as heart disease and anti-aging properties (Robinson, 2015).

Mutton is a traditional meat with a reliable taste, containing every essential amino acid and being an excellent source of CLA (Blythman, 2013). Kennard (2014) says mutton is nutrient dense and, while its mineral content tends to depend on the local soils, is always significantly high in vitamin B12. It has higher omega-3 levels than beef because of the shorter grass that sheep consume and its quicker passage through the rumen, meaning more is absorbed into the muscle. Mutton has been found to be 40% higher in omega-3 than lamb and provides the closest-to-ideal ratio of omega-6 to omega-3 (1:1) at 2:1. In short, the older the animal, the better the ratio. Meat flavour develops with age (Fisher et al, 2000) and mutton is a great example of this.

2.2 GENETICS

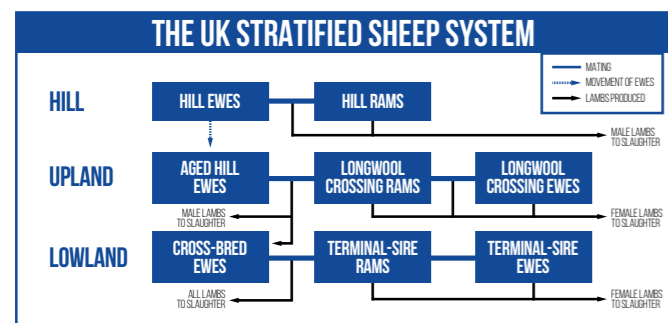
NSA believes upland and hill areas would benefit from:-

- Recognition of the value of upland and marginal sheep genetics to the UK gene pool and its wider sheep systems.
- The development of practical health assurance schemes and increased sharing of information by sellers to give confidence to buyers of breeding stock and store lambs.

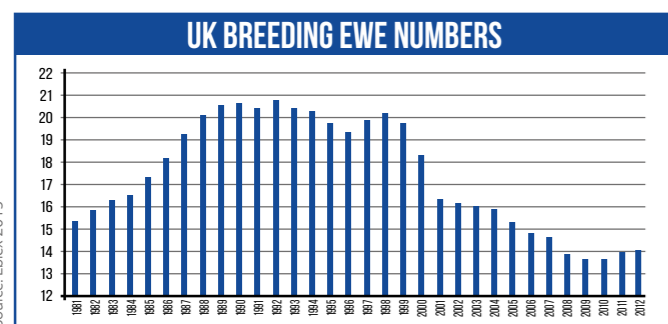
There are more than 60 recognised pure breeds of sheep in the UK and more than 80 recognised breed societies when you include crosses, halfbreds, Mules and composites. Most countries only have a handful (Rhys-Davies, 2010). NSA estimates almost two thirds of these relate to native hill and upland breeds. This high number of breeds provides a uniquely broad base of genetic diversity with some genes, particularly those of upland breeds, not found anywhere else in the world. In 1992, the United Nations held the Rio de Janeiro Earth Summit and, as a result of this, the Convention on Biological Diversity (CBD) was formed. The concept, and subsequent direction of the CBD for domesticated species has been 'to conserve and sustainably use biological diversity for the benefit of present and future generations' (United Nations, 1992).

The stratification of the sheep industry is unique to Britain and makes the most of the topography and local breed traits found in each area. It can be both

economically and biologically efficient (NFU & NSA, 2014) and the movement of stock from one land type to the other depending on the time of year is crucial to farm operations (Mansfield, 2014). Traditional hill and upland breeds are physiologically suited to the harsh conditions and are efficient at producing and maintaining body condition from low inputs and relatively poor vegetation, often 'browsing' the vegetation to naturally control scrub (Forestry Commission Scotland, 2016a). Ruminants are unique in being able to turn this vegetation into an edible product for humans, and producing the same amount of red meat without access to these areas would force this stock to compete for land in areas more suitable for the production of cereals (Sargison, 2012). Stratification brings genetic diversity to the national flock, providing suitability for a diverse range of environments, production systems and longevity of production in the face of future challenges (Sargison, 2012). The loss of vital traits from hill ewes, such as good mothering ability and hardiness and traditional instincts such as hefting, would change the upland and lowland face of the British sheep industry. The removal of native breeds would also be a loss to the culture and heritage of these areas. However, change is already being seen. Pollott (2012) found that between 1987 and 2012, although the numbers of purebred ewes had decreased, the number of crossbred ewes had largely remained the same, indicating there has been a shift in production away from the uplands.



The drop in national ewe numbers since 2003 is largely due to a reduction in ewes from the three main hill breeds – Scottish Blackface, Swaledale and Welsh Mountain. New technology, information and market pressures have driven a decreased reliance on the pedigree sector (Pollot, 2012) and the 86:14 ratio of stratified to non-stratified flocks in 1971 has dramatically altered to 55:45 in 2012 (Pollot, 2012). Although the traditional Mules and halfbreds still dominate the British sheep industry and are the main contributors to the UK lamb crop as it currently stands (Pollot, 2012), a continued move towards more 'ad hoc' crossbreeds would result in the breakdown of the traditional stratified system. Mules and halfbreds in all their guises are prime examples of outbreeding enhancement (known as hybrid vigour or heterosis). They are the choice of many lowland farmers to cross with a terminal sire, as they combine the hardiness and longevity of the hill ewe with the prolificacy of the Bluefaced or Border Leicester longwool ram, producing prolific, fast growing female replacements with good mothering ability (NEMSA, 2014). Around 41% of crosses are either sired by the Border Leicester (halfbred type) or Bluefaced Leicester (Mule), down from around 50% in 1971, and the balance has more recently swung in favour of the Mule type (Pollott, 2012). In fact, halfbred types have become less numerous than they traditionally were, now making up less than 0.1% of the national flock (Pollott, 2012).



A study comparing upland grazing by various breeds found traditional upland breeds (represented by Scottish Blackface and Swaledale cross Blackface ewes in the work) had a higher preference for shrub vegetation, such as heather, resulting in higher levels of this in their diets. The Blackfaces were found to forage over larger areas of the hill than other breeds and were willing to move further away from the rest of the flock than other breeds, resulting in the lowest social bonds. It was therefore concluded that Blackface and Swaledale crosses were the best suited to managing the upland environment, as their foraging behaviour can be used as a useful management tool for the control of under grazing whilst complying with regulations for cross compliance and EU directives at the time (McCloskey, 2010).

Foundations for valuable gene banks have been built by the Ovine Semen Archive and the Rare Breeds Survival Trust, but they require continual assessment and replenishment. Further to its statement on conservation for food and health of the growing world population, the CBD added that 'access to and sharing of both genetic resources and technologies are essential' (United Nations, 1992). NSA is striving to promote the need for a

GENETIC IMPROVEMENT IN THE UPLANDS

Genetic gains can be made in sheep flocks by collecting performance data and using estimated breeding values (EBVs). This helps to select breeding stock with genetic merit appropriate to the system it is reared in. NSA member Samuel Wharry from Carnlough, County Antrim (pictured), has been performance recording his Scottish Blackface flock since 1997. His primary aim was to maintain ewe size and avoid having too many small 'tail end' lambs. Sam says: "The first few years were purely about collecting information on the ewes and, at first, we didn't pay that much attention to maternal traits – but it soon became clear which ewes had the better maternal figures. These were the ewes that were rearing the best lambs with the least difficulty." Maternal Ability EBVs are an assessment of the growth rate of the lamb to eight weeks of age, according to the maternal care and milk production of the ewe. Sam continues: "Since then we've been selecting replacement ewe lambs primarily on their performance EBVs, particularly concentrating on maternal and growth traits, but also maintaining breed character. Our lambing ewes are very capable of rearing twin lambs on their hill by themselves. Although recording for maternal performance was a long term strategy, it has paid off with results quicker than I expected. My Scottish Blackfaces are the cornerstone of this farm; they not only produce replacements for the purebred hill flock but also for the lower ground crossbred flock. Their performance is vital for the viability of the entire enterprise."



national gene bank, and protocols to mitigate a disease-related cull that would wipe out gene pools within certain breeds predominantly found in only their native area of the country, such as Herdwick and Lonk. Genetic traits of hill ewes found in ewes producing British lambs have fallen to 37% as a result of there being fewer hill ewes and fewer Mule/half breed types, but this is still the greatest percentage of dams of lambs (Pollott, 2012). A survey by the North York Moors National Park Authority found that flocks in the area have been decreasing by an average of 3.5 flocks per year since 1998 (Edwards, 2006). Populations of some of the less numerous hill breeds have fallen over the past few years. For example, there were 35,000 Lonk ewes in 2003 compared to 20,000 in 2012, 32,000 Rough Fells down to 17,000, and 16,000 Derbyshire Gritstones down to 11,000 (Pollott, 2012).

The loss of the hardy upland breeds would also signify the end of traditional practices such as hefting of large open tracts of land, such as commons, where sheep graze their own heft without straying and know the best places for food and shelter. Supported by careful shepherding, each generation of ewe passes this knowledge onto her lambs. Traditionally, hill breeds were born and reared, shepherded and remained on the heft, with persistent wanderers culled, leaving a strong instinct and inherent ability to heft, with a developed tolerance to mineral deficiencies, plant toxins and specific diseases for the area (Davies et al, 2008). The monetary value of a hefted flock is estimated at around 50% above the market average, but in practical terms it is priceless as it would be totally irreplaceable due to the shepherding and labour requirement. The cost and labour is estimated at £125,688 for 1,000 ewes over three years (Davies et al., 2008) but it is arguable that the skills needed simply do not exist anymore. Taking sheep off the hills, or losing the traditional hill sheep for more modern or commercially encouraged breeds, would therefore result in the loss of this practice altogether. A well hefted hill of several flocks promotes uniform grazing (Davies et al, 2008) in the creation of a mosaic of habitats with different grazing pressures, rather than creating areas of over or under grazing. In cases of multiple hefted flocks sharing a hill or common land, a strong cooperation of graziers is essential and synchronised activities, such as treating for sheep scab, are compromised if the farmer has had to seek alternative employment and agriculture remains a part time activity (Davies et al, 2008). Tourism in hill and uplands areas is ever increasing and is an important part of the jigsaw, but if sheep are not fully trained to their heft, walkers and dogs will cause them to wander. Neighbouring hefts act as barriers for the sheep to stick to and any removal of these neighbours also encourages sheep to wander. This in turn promotes selective grazing, the encroachment of scrub and bracken, the increased incidence of ticks and associated diseases and fire risk (Davies et al, 2008). The introduction of agri-environment schemes was initially beneficial to farmers post foot-and-mouth disease in 2001, providing a financial incentive to graze a larger area at a reduced stocking rate. The majority of hill farms, hefted flocks being no exception, rely heavily on payments from these schemes (Davies et al, 2008) but stocking prescriptions are too often inflexible and reduced stocking rates and the total removal of stock over the winter months has compromised the hefting instinct (Davies et al, 2008) and potentially reduced hardiness of stock due to winter housing and different stock selection criteria. Additionally, the income forgone principle of calculating agri-environment schemes has meant it is too easy to attach payments to reducing numbers, to the extent that there is substantial habitat degradation in the uplands, including 530 sites of special scientific interest (SSSI), from a lack of effective grazing (English Nature, 2005).

Alongside the strong arguments in favour of protecting genetics and breeds, there is also the need to work within these gene pools and sheep breeds to make progress and improvements. A recent study commissioned by AHDB Beef & Lamb and written by Amer et al (2015) concluded the realised returns from genetic improvement in sheep were substantially below their potential in the UK. The main challenge is the unrivalled amount of sheep breeds in the UK, as accurate genomic predictions require large populations being phenotyped and genotyped. The benefits are less recognised in breeds whose strict breeding objective focus on terminal traits and, as discussed previously, terminal type breeds are increasingly used to provide replacement ewes at the detriment of the maternal ewe flock performance. The greatest opportunity for the benefits of genomic selection are likely to be in maternal traits, including resistance or tolerance of diseases, and in traits that will save costs by increasing the ease of care of the sheep (Amer et al., 2015). The use of estimated breeding values (EBVs) and genomic breeding values to improve genetic potential can aid in reducing the carbon footprint of sheep enterprises (Hyland et al, 2016) but improving performance must remain within the boundaries of the industry, as methods of improving pasture in the hills and uplands is extremely limited. It is imperative that the industry works together to give profitable, well managed production and sustainable management of disease control (Sargison, 2012). Health, parasite control and disease must be taken more seriously in order for the system to survive. The regular sale of sheep from the uplands to the lowlands means gains could be made from known health statuses, the passing of information between supplying and receiving farmers, and proper quarantining (NADIS, 2016).

2.3 WOOL AND SKINS

NSA believes upland and hill areas would benefit from encouragement of retailers and consumers to consider the unique benefits of British wool in an attempt to get better and fairer prices for sheep farmers.

Once a year, during the warmer months, sheep are gathered off the hills for shearing, a process required for the benefit of their welfare (BWMB, not dated). The thick, greasy fleeces designed to help them survive the harsh winter months can lead to health and welfare problems in summer. Flies lay their eggs in the wool and their larvae burrow into the skin of the sheep, causing the discomfort and infection referred to as blowfly strike. Depending on the breed of the sheep, a fleece can weigh anything between 1.5kg and 10kg (BWMB, not dated). The wool from upland breeds is used to produce carpets, clothing, furnishings and insulation (Natural England, 2013a). In the 2015 wool season, total production was more than 28.7m kg, made up of 14.1m kg in England, 7.6m kg in Wales, 5.6m kg in Scotland and 1.2m kg in Northern Ireland (BWMB, 2016).

Wool is an excellent natural carbon store; carbon constitutes around 50% of the organic matter of the fleece, sequestered from the current atmosphere around one to two years earlier, unlike synthetic fibres which use carbon extracted from fossil fuels, de-sequestering what has been stored over millions of years (IWTO, 2014). Wool as a hygroscopic fibre absorbs water vapour from the rising air humidity, generating and retaining heat in the process and

making it a natural insulator (Campaign for Wool, 2016a). When used in the home, wool reduces carbon emissions and energy costs by preventing a loss of energy to the external environment (Campaign for Wool, 2016a). Wool has the unique ability to absorb and retain harmful substances like formaldehyde, released from modern building materials such as pressed wood and medium-density fibreboard (Thermafleece, 2014). Unlike porous materials that act as sinks to these harmful substances, the wool fibres bond with them permanently meaning they will not pass through the wool barrier or be re-emitted into the atmosphere for the lifetime of the wool insulation (Thermafleece, 2014). Wool is also flame retardant due to its high water and nitrogen content, and has a far higher ignition threshold than synthetic fabrics (Campaign for Wool, 2016a).

Despite the quantity of wool produced in the UK and its incredible properties, income for the product is very low. At one time it was incredibly valuable and provided an important income stream, but the rise of synthetic fibres in the 19th and 20th centuries brought an end to this and for most farmers, apart from those running specific wool breeds, wool is a by-product that only contributes marginally to the bottom line, at best. Farmers can expect to pay an average of 90p-£1.10 per sheep for shearing, with returns usually expected to be £1-£3 per sheep per year (Hunter, 2015), although Glover & Cazalet-Smith (2013) reported of a Herdwick farmer receiving 50p per fleece, and his total costs of shearing, bundling and transport amounting to £1.50 per fleece, three times what he was being paid. Despite the cost, professional shearing is essential for animal welfare and securing the best quality fleece, as cutting the fibre more than once creates mixed fibre length, lowering the value of and damaging the fleece (Hunter, 2015). Wool is now a by-product in the UK and across many northern European countries, as 90% of income comes from meat. There is therefore little genetic selection of upland breeds to enhance wool traits, with genetic selection focus being almost entirely on environmental adaptability and carcass conformation. As a result, wool fibres from UK sheep are highly variable in length, diameter, crimp and colour, related to breed and environmental conditions (Hunter,

PROMOTING THE VALUE OF BRITISH WOOL

NSA member David Griffiths and wife Karen, keep just over 90 sheep on the Derbyshire/Staffordshire border. In April 2009 they opened Griffiths' Mill as a mini woollen mill processing fleeces from their own sheep and those of customers throughout the country. When attending numerous shows and events and selling woollen yarns and carded wool around the world, it became obvious to them that more education about Britain's wool heritage was needed. Karen says: "The number of people we met at shows who did not know wool came from sheep, or that its removal was for the health of the sheep, was amazing." After months of planning and gathering support, David and Karen launched 'The Woolly Roadshow' in spring 2016, an educational promotion of British sheep breeds and their wool. It displays and sells a range of British yarn, carded fibres and other innovative woollen products, and also includes hand spinning and felting demonstrations. It provides information about the work of NSA, British Wool Marketing Board and Rare Breeds Survival Trust. Karen adds: "Years ago our farmers valued their wool and sheepskins as much as their meat, but we allowed people to tell us fleeces were of little value and then many people started to treat them as such. While every fleece is not suitable for every purpose, we do have a fleece in Britain for every purpose. We need to re-educate everyone about the true value of our fleeces."



CASE STUDY

The value of wool has improved in recent years, in no small part due to the launch of the Campaign for Wool in 2010. Farmers have seen a threefold increase in the price, albeit from a low base. The campaign, initiated by patron HRH Prince of Wales and funded by a number of international partners included the British Wool Marketing Board (BWMB) in the UK, is a global endeavour collaborating wool growers, fashion designers, retailers, interior designers and manufacturers and re-educating customers on the myriad of wool uses. From fine knitwear, cloth, hard-wearing interiors and flame-retardant home insulation, the campaign is helping to create a new international demand for wool, raising awareness of its unique natural, biodegradable and renewable properties (Campaign For Wool, 2016b).

Skins are also largely considered to be a low value by-product of the sheep industry in the UK, but there is still demand for them, mostly from overseas where regulations are less strict and production costs are much lower (AHDB, 2014). In 2013 79% of UK sheep skins were exported to China, followed by 9% to Turkey and 9% to the EU. The export total for 2013 was 64,000 tonnes, which is roughly 14 million skins out of a total of 14.5 million sheep slaughtered (AHDB, 2014). Domestic demand is limited to only three UK tanneries, although the possibility of a fourth opening in Wales in the near future in bucking a trend of decline across many decades. Pollution caused by tanneries added to the pressure to survive as cheaper, synthetic materials were developed, but the three surviving UK ventures all pride themselves on minimal environmental impact. Organic Sheepskin in Herefordshire uses only vegetable tannins and has its own reed bed to clean grey water and supports its own ecosystem (Organic Sheepskin, 2016). Organic Sheepskin concentrates on rug production while the Devonian tannery on the edge of Dartmoor has been operating for more than 200 years and uses locally sourced, high grade lambskins to produce a wide range of products, including rugs, footwear, equestrian products, paint rollers and car seat covers (Devonia, not dated). Skyeskins on the Isle of Skye, Scotland, is a working tannery and the islands only five-star visitor attraction. It produces its own range of rugs, as well as working with several British manufacturers of coats, gilets, handbags, slippers and boots (Skyeskins, 2016).

NSA believes upland and hill areas would benefit from encouragement of retailers to embrace heritage breeds as new and diverse products, resulting in more mainstream interests in these niche markets.

It is possible for some farmers to increase their profits by creating a premium or niche market, directly selling lamb and mutton or working with other market players, such as butchers, regional food hubs and retailers. This is an ideal opportunity for hill and upland farmers looking to finish at least a proportion of stock on their own farms for sale at farm shops, farmers' markets, specialist outlets and online, or by co-operating with existing regional food hubs and supplier networks. However, it must be remembered that the niche market sector accounts for just 1-4% of total UK sheep output (Federation of Cumbria Commoners, 2011a) and there is a limit to its growth potential outside of mainstream retailers.

The large number of native breeds in the UK, coupled with an array of iconic areas and landscapes, means there are excellent opportunities to create a strong brand identity for products. These brands can appeal to consumer values around welfare, food safety, food miles, taste and the environment (Federation of Cumbria Commoners, 2011b) or powerful niche terms such as organic, pasture-fed and local (Rhys-Davies, 2010). Producing lamb that has a strong and distinctive taste, from a native breed farmed on a long-established holding, gives a positive feeling of food safety, and buying it directly from the farmer means low food miles, appealing to the consumer's need to be 'greener' in their daily activities (Federation of Cumbria Commoner, 2011b). Heritage and rare breeds are perfectly suited to optimising meat production in the particular geographic and climatic conditions of their natural habitat (CPRE, 2012). They also add to the cultural heritage of the area, with their distinctiveness and variation, and provide a 'genetic bank' for breed diversity, which may help tackle disease and provide resilience in the future (CPRE, 2012). Consistency is of vital importance when marketing such products and, although this can often be hard to achieve, groups of farmers working together can move towards solving the issues of different soils and locations (Federation of Cumbria Commoners, 2011b). Farmers who share grazing on common land would also have an opportunity to cooperate in marketing their unique product (Federation of Cumbria Commoners, 2011b). Creation of niche products encourages entrepreneurship, an opportunity for young people and new entrants (Scottish Government, 2000).

RETAIL SUPPORT OF A HERITAGE BRAND

Marks and Spencer's has gained a lot of momentum since entering the food retail sector, increasing revenue by another 3.4% (£5.2bn) in 2015 (Marks and Spencer, 2015). One success story within its 'speciality' range has been offering Swaledale lamb through the winter months for the last six years. The Swaledale is a maternal breed and a specific outlet for finished male lambs is of huge benefit to breeders. M&S works alongside the Swaledale Sheep Breeders Association to source lambs of a specific specification, which is 16-21.5kg with correct conformation and fat levels. John Stephenson of the Swaledale Sheep Breeders Association describes how the scheme has grown. He says: "The first season lasted for 10 weeks, with 250 lambs from 13 members being sent to the Dawn Meats abattoir. The sixth season lasted for 21 weeks, from the end of December 2015 to the end of the first week in May 2016. This saw 40 members supplying a total of 10,500 lambs."



CASE STUDY

HERDWICK SPECIAL STATUS

Around 99% of Herdwick sheep are commercially farmed in the central and western Lake District and 95% of them are within 14 miles of Coniston, Cumbria. The Lakeland Herdwick breed gained protected designation of origin (PDO) status in 2012 meaning Herdwick products and foodstuffs produced, processed and prepared in this area are protected from misuse and imitation. Amanda Carson of the Herdwick Sheep Breeders Association says: "This European standard of protection and promotion ensures product quality, provenance and full traceability, protecting a traditional farming system and giving consumer confidence. A scientific study at Bristol University found Lakeland Herdwick meat to have unique levels of omega-3 and a beneficial higher proportion of total fats and poly-unsaturated fatty acids. The meat is renowned for its distinctive flavour and quality as a result of the slow maturing breed grazing on heather and indigenous grasses. Lakeland Herdwick mutton provides the best example of the full flavour as it has had the time to develop." Despite the success of PDO, and similarly protected geographical indication (PGI) status, very few sheep meat brands benefit from it – and none may be able to once the UK leaves the EU. The exceptions are West Country Lamb (PGI), Welsh Lamb (PGI), Scotch Lamb (PGI), Shetland Lamb (PDO), Orkney Lamb (PDO) and Isle of Man Manx Loaghtan Lamb (PDO) (Wikipedia, 2016b).



CASE STUDY

Because niche sheep products can be based on either a breed or a geographical location, they can help raise the profile of lamb and red meat and bring the producer closer to their market. It is therefore arguably important for the industry to create more mainstream interests for currently niche products to sustain populations of rare and upland breeds. Farmers need a bank of market knowledge and a will to cooperate if they are to be encouraged into niche market entrepreneurship, allowing them to develop marketing, branding and sales plans, finding potential customers (Scottish Government, 2000) and, once established, staying connected with changing market trends. With the wealth of abilities that farmers need

to run their sheep flocks, it is not always practical or possible for them to develop a whole other skillset related to branding, marketing and sales. Retailers have this expertise but do not have a track record of interest in creating mainstream interests for niche products to sustain populations of rare and upland breeds. The exception was following foot-and-mouth in 2001 when some retailers introduced schemes generating demand for high quality, light lambs (16-21kg deadweight), which was ideal for hill lambs (Federation of Cumbria Commoners, 2011a).

For farmers that are engaged in niche markets, it is important they stay connected with the consumer and recognise the constantly changing trends in order to meet market demand (Federation of Cumbria Commoner, 2011b). This may include targeting ethnic and minority markets, particularly for products like mutton (Federation of Cumbria Commoners, 2011a), or expanding their own business by lambing for longer periods, building additional housing or freezing carcasses (Federation of Cumbria Commoners, 2011b). The ethnic market makes up more than 25% of the UK demand for sheep meat, much of this being mutton, and so markets can be planned to match peak demand periods over and above the traditional peak always seen at Easter. For the Islamic calendar these include Eid al-Fitr (to celebrate the end of Ramadam) and Eid al-Adha (the tradition of families sacrificing an animal, keeping one third for themselves and giving one third to relatives and one third to the poor and needy) (Federation of Cumbria Commoners, Commoners, 2011a).



NSA believes upland and hill areas would benefit from:-

- **A farm support and reward system, developed post-Brexit, which caters for all agricultural sectors but specifically increases the financial recognition of provision of a broad range of public goods.**
- **Payment (via public and private means) for eco-system services based on reward and deliverables, and not income foregone.**

The European Common Agricultural Policy (CAP) was established in 1962 (Wikipedia, 2016a) and has a long history of financially incentivising farmers to provide public goods rather than simply responding to market indicators. Long after its establishment in the aftermath of the world wars, the CAP continued to encourage productivity to feed a growing population. Livestock headage payments under Pillar One of CAP were one tool to do this, but this blunt format encouraged the keeping of sheep for numbers along, resulting in overproduction and the sector not being in line with market demands. The 2003 CAP reform 'decoupled' the link with production and moved to area-based payments as a way to encourage livestock sectors to move towards a free market and allow farmers greater freedom to respond to market demands (European Commission, 2016). Both the Single Payment Scheme and its recent successor, the Basic Payment Scheme, have used an area payment to distribute of Pillar One funds.

EU FUNDING TO MAINTAIN SHEEP NUMBERS

The most recent CAP reform resulted in Scotland adopting an area-based scheme that massively weighted payments to productive, lowland areas. Concerns that a low area payment for poorer, rough grazing (so called 'region 3') would see sheep numbers drop even further in these areas, the Scottish Upland Sheep Support Scheme was designed to target active farmers. A budget of €8m was allocated to be split across the total number of ewe hoggs claimed on by farmers and crofters in region 3, with a limit of one ewe hogg per 4ha. NSA member Sybil Macpherson, who farms an extensive flock in Argyllshire, says: "It was hoped the scheme would to bring support payments to active farmers in region 3 more in line with land in region 2, which is better quality rough grazing and attracts a higher area payment. However, there were 14,000 more eligible hoggs claimed for than expected, meaning the anticipated rate of €100/hogg dropped considerably. There have been a number of issues which have emerged following the processing of claims and it now appears a review of the scheme will be possible. It is essential that steps are taken to improve this much-needed scheme."



CASE STUDY

Among other factors, the impact of this decoupling and the devastation of the 2001 foot-and-mouth epidemic caused livestock numbers in the UK to drop dramatically, particularly in more marginal areas. Other factors were poor market prices, the hangover of the BSE crisis in the late 1990s, culling linked to bovine TB, new requirements for slurry storage in nitrate vulnerable zones (NVZs), agri-environment scheme guidelines and an aging farming population (Cumulus Consultants Ltd, 2012). Breeding ewes declined by 12% in English LFAs and 20.2% in Welsh LFAs between 2000 and 2010. Worst affected were Northern Ireland and Scotland with reductions of 31.6% and 31.7% respectively. Overall grazing pressure in Scottish LFAs was also worst affected, with a reduction of 16.3% (Cumulus Consultants Ltd, 2012). While other EU countries have taken steps to avoid the loss of farming in vulnerable regions, with the continuation of coupled payments in the form of sheep and goat premiums (European Commission, 2016), the UK has not widely followed suit. The only example is that the Scottish Government has implemented a beef calf scheme since 2005 (Scottish Government, 2006) and is in the process of administering the first year of a new ewe hogg headage payment in areas of rough grazing. The sheep scheme is a direct response to concerns over the viability of sheep farming in these marginal areas and the risk of losing the public goods provided by this type of activity (Hall, 2015). Particularly given that the UK will soon need to write its own agricultural policy outside of the EU, it is important to discuss the role of payments relating to production – and also acknowledge the debate around whether direct funding should go to the more productive land, which is more likely to be commercially viable, or to the hills and uplands that need protecting. Recognition of this has arguably begun to happen in England, the first UK nation to fully move to area based payments, where changes have recently been made to the payment rates to 'move money up the hill' and reduce the difference in values given to lowland and more disadvantaged areas.

While agri-environment work has traditionally been part of Pillar Two of CAP, the newer Basic Payment Scheme has 'greening' requirements that all farms must meet in order to qualify for direct funding (RPA, 2015). Across Europe, the greening rules aim to encourage rotational mixed farming including grassland, because of its biodiversity value. Farms with more than 75% permanent pasture are exempt from greening requirements, showing the value placed on this type of land. This means nearly 100% of farms in the upland and hill areas of the UK already provide the level of public goods required by greening, which is something that needs to be recognised when the UK is replacing the EU CAP.

Pillar Two of CAP is the EU Rural Development Policy, aiming for economic, environmental and social improvement of the countryside. Strategic priorities include: knowledge transfer and innovation; competitiveness and viability; food chain organisation; ecosystem management; low carbon and climate resilience; and social inclusion, poverty reduction and economic diversity (Dwyer et al, 2016). In the UK the majority of Pillar Two funding is dedicated to the environmental element of rural development – 87% on the most recent CAP and previously 83% (Defra, 2014a) allowing many businesses to supplement production with environmental practices. Agri-environment schemes vary between EU countries but they all aim to protect biodiversity, restore landscapes, prevent rural depopulation, and reduce pesticide and nutrient emissions (Kleijn, 2003). The uptake of schemes has been highest in areas of extensive farming, where biodiversity remains fairly high, and lowest in areas of more intensive farming where biodiversity levels are low (Kleijn, 2003). At its peak, 70% of the farmed land in England was under an agri-environment scheme, covering 6.4m ha with 52,000 farmers participating (Orford, 2015). An updated scheme under the recently reformed CAP has more complex requirements and resulted in a reduction from this level, although it is not yet clear how many farmers will sign up to

the new environmental land management schemes (NELMS). Scotland's Rural Development Programme receives the lowest level per hectare of EU funding support, but at its peak in 2005 covered 1,324,000ha of farmed land (RSPB Scotland, 2007). The Glastir scheme in Wales, which includes many specialised schemes, has the participation of 5,350 farm businesses, and 11,600 farmers in Northern Ireland participate in agri-environment schemes, covering 438,000ha (Orford, 2015).

BOOSTING WILDLIFE WITH ENVIRONMENTAL STEWARDSHIP

NSA member Maurice McHenry farms 120ha on the north coast of County Antrim, Northern Ireland. This includes 61ha heather moorland, 32ha rough moorland grazing, 18ha unimproved grassland, 6ha improved grassland and 2ha species-rich grassland. The sheep enterprise is farmed to meet the requirements of an agri-environment scheme so, for example, ewes have no access to the heather between November and February, fertiliser is spread on only 10ha of land, and no sprays or herbicides are used on the heather or rough moorland grazing. Maurice says: "In 2009 the farm was awarded Most Beautiful Farm in Northern Ireland and was a finalist in the UK Silver Lapwing awards for commitment to the environment. Since 2002 it has been an Agri- Food and Biosciences (AFBI) research farm and DARD focus farm for promoting sheep in a hill farm situation. The Farming and Volunteer Alliance did a survey of the farm on a number of occasions and identified more than 33 species of birds and at least five sites for frogs. Sheep play a complementary role in ensuring a diverse flora and fauna. Without sheep the natural vegetation would be unchecked and smother the smaller plants. Sheep do not poach the wet areas on the moorland or species-rich grassland and so this land is protected." steps are taken to improve this much-needed scheme."



CASE STUDY

Current agri-environment agreements are legally binding, yet there is still uncertainty around what will happen once the UK leaves the EU. The role of agri-environment schemes will be one of many things to consider in the forthcoming discussion about where to prioritise future funding, but there are opportunities to think about where improvements can be made, specifically linked to 'ecosystem services'. Recognition of ecosystem services places hill and upland sheep farming in a position that cements the importance of its multiple outcome and holistic approach, acknowledging that production from traditional livestock systems works in balance with ecosystems and rural communities. For instance in-bye hay meadows may be relatively intensively grazed and cut, compared to much lower levels of intensity on heather hills and wet peatland ground. Farming the land in this way maintains valuable environmental habitats and delivers ecosystem services that are highly beneficial to society as a whole, but can be a serious limitation on farm business productivity and profitability. Agri-environment schemes are currently the only attempt at paying for this, but are calculated on an income foregone principle so compensate only for what income is lost by agreeing to manage land according to a particular scheme. NSA believes it would be beneficial to pay for ecosystem system services instead. This is particularly true when agri-environment is placed in the context of 'sustainable intensification', which is a priority in an era of growing global demand for food. Bangor University's work on this concept in the uplands aims for the most productive land to be utilised effectively, and the least productive land managed to attract payment from agri-environment schemes for ecosystem services (Williams, 2016).



FINDING A MECHANISM FOR ENVIRONMENTAL OFFSETTING

The recently-formed Black Mountains Land Use Partnership is a collaboration among landowners, graziers and relevant regulatory bodies, including the Brecon Beacons National Park, which aims to restore and sustainably manage the Black Mountains natural resources within the 24,600ha of predominantly upland hill. Phil Stocker, NSA Chief Executive and BMLUP Chairman, says: "The Black Mountain, like other upland areas of the UK, provide multiple environmental, social and economic benefits to local communities and visitors, from good grazing for food production, to access and diverse wildlife for the public, to the storage of carbon in large areas of wet peat soils, and the supply of water to regionally important rivers and streams. It is a struggle to sustain farm businesses and without CAP support and agri-environment income few farms would be profitable – a situation that fails to encourage young people to stay and farm in the area. This, coupled with an uncertain future for support payments, has inspired BMLUP to explore ways for potentially private or public payment for ecosystem services. It is applying to the Welsh Government Sustainable Management Scheme to develop a mechanism for brokering relationships and payments for ecosystem services that could be used to offset environmental damage elsewhere caused by development or high resource use. If achieved this income could start to apply a positive value to managing high value habitats and carbon stores in sustainable ways."



CASE STUDY

Looking beyond the system of EU payments linked to the public goods provided by agriculture, there is also a growing acknowledgment of the 'natural capital' held by and generated by farming practices, such as soil, water and air, particularly in the hills and uplands of the UK. Natural capital and ecosystem services are concepts with an increasing relevance to farming, as putting a price on nature's assets can enable a price to be paid to people who maintain and enhance it. In the 2011 UK National Ecosystem Assessment it was estimated that the value of UK ecosystem services and the habitats and organisms providing them was billions of pounds (British Ecological Society, 2015). Natural capital underpins all other capital in economy and society, and covers the actual stock, living and non-living aspects of nature producing direct and indirect value to people. Ecosystem services are about the flow of benefits that this stock provides and that are derived from these assets, in provisional, regulatory, support and cultural services (British Ecological Society, 2015). The Natural Capital Committee (2015) describes English natural capital as being largely in decline, and that it must be safeguarded for sustained economic growth. Natural capital is a move towards making sure that nature is considered in economic decisions (British Ecological Society, 2015) and may be an opportunity for a commercial future for farmers. For example, commercial businesses with a large environmental impact, such as airlines or power companies, could off-set this by paying farmers for natural capital and/or ecosystem services. This could perhaps fund bracken control to encourage biodiversity, pay for peat management to capture carbon, or support community-based activities in rural areas to protect the societal infrastructure of hill and upland areas. There is significant potential for the improvement of natural capital in England, and the Natural Capital Committee (2015) propose several options within an investment programme, such as woodland planting, peatland restoration, wetland creation and the improvement of environmental performance of farming.

Pillar Two of the EU CAP is not just about agri-environment schemes. It also covers natural handicap (the new Areas of Natural Constraint) and Natura 2000 measures, as well as focussing on delivering public goods through rural vitality. This is delivered by maintaining and promoting natural heritage, farm diversification and tourism activities through modernisation and infrastructure development measures, and/or grants for funding activities in rural areas. Pillar Two funding can also improve human capital by providing advice, training and capacity building measures. The main focus of much of the funding is to improve the competitiveness of the agricultural and forestry sectors, but this can directly or indirectly provide public goods, for example reducing greenhouse gas emissions through the funding of new, efficient buildings and equipment (Hart et al., 2011).

These areas defined by the EU as integral to a successful agricultural sector are as appropriate for the UK as elsewhere in Europe and should be considered for the UK's agricultural policy post- Brexit. NSA would also like to see its suggestion of an agri-health scheme be further discussed in the new political situation, as small-scale trial work of this has been very promising. In 2013, NSA put forward a set of objectives towards the creation of an agri-health scheme funded from the Pillar Two budget, which would reward farmers for measures such as voluntary monitoring and health initiatives, while fitting within the Pillar Two aims of improving competitiveness, environment and quality of life. It argued an increasing population with its growing food demand was an ever increasing struggle as resources become limited and climate change poses an increasing challenge. The scheme proposed would deliver public goods by increasing food security and food production with a reduced carbon footprint, and therefore contributing towards the UK target of reducing carbon emissions by 11% in 2020 and by 50% in 2050. It would promote better use of resources, often limited in hill and upland areas, and help sustain livestock numbers for the benefit of landscapes and communities. These objectives were incorporated into a project run by Hybu Cig Cymru (Meat Promotion Wales), which worked with five vet practices and 11 beef and sheep farms in Wales between October 2014 and June 2015 (HCC, 2015). Each farm was allocated £3,000 for the potential costs of any tests and treatments, and initial veterinary consultations were followed by investigations, testing and eventually an updated health plan. The project was very successful in allowing more time for farmers and vets to discuss issues and resulted in improved performance for greater economic benefit to the farmer (HCC, 2015). In one particular case study, the farmer spent more time with the vet looking at lamb losses between scanning and selling, and resulted in a more targeted approach to worm management, strict management of contagious diseases, and a review of the vaccination plan for the flock (HCC, not dated). Helping the farmer become for efficient also reduced the carbon footprint of the enterprise.

There is no doubt that farming and the environment are inextricably linked, with 75% of the UK landscape devoted to farming (RSPB, 2013). Our unique landscape formed through thousands of years of traditional farming methods and environmental management by farmers, including the grazing of sheep, has encouraged the adaptation of many animal and plant species. The late 1990s and early 2000s saw financial incentives push up stocking rates, but the end of headage payments and introduction of environmental stewardship schemes have been widely welcomed by farmers to reverse the negative effects on biodiversity and the environment. However, this has gone too far in some scenarios and reduced stocking rates of sheep in certain parts of the UK hills and uplands are leading to degradation and real changes in habitat structure. NSA believes it is vital to find the right balance and finds support for this in the Convention on Biological Diversity's (CBD) stance that 'states are responsible for conserving their biological diversity and using their biological resources in a sustainable manner' (United Nations, 1992).

Since the 1980s, fertiliser use has been steadily decreasing and crop production increasing, meaning farmers are using fertilisers more effectively and harnessing technological developments. Some of the more environmentally damaging pesticides are no longer used due to voluntary best practice measures (FACE, not dated) and the creation of agri-environment schemes, provided through Pillar Two CAP funding, has aimed to encourage best practice farming for the benefit of the environment. However, it is important to remember that in order to be sustainable and not adversely affect the amount, cost and quality of our food, programmes to improve biodiversity must be carefully thought out and applied to individual situations and habitats, not just a case of 'everything everywhere' (FACE, not dated). Farmers must be able to tailor schemes to best fit their practices and the land on which they farm, to get the best value for money in both production and environmental benefits.



NSA believes upland and hill areas would benefit from deeper understanding of the role sheep and the uplands play in prevention and mitigation of flooding and the supply of vital clean water to many urban communities.

The ever-growing world population means there is an increasing requirement for water, yet the effects of climate change mean there are simultaneously more droughts and water shortages. Parts of the world that suffer from the most extreme droughts may no longer be able to produce enough food and predictions suggest the UK may have an increasing future role in feeding the world. At the same time, around 70% of our drinking water is sourced from the uplands catchments, highlighting the importance and strong overlap between a healthy natural environment and the wider public benefits that can be brought from its successful management. The naturally low nutrient levels in upland soils makes for a higher quality of water, requiring less treatment and therefore a lower cost to the public (Natural England, 2013a).

At the other end of the scale, the devastating floods of winter 2015, which Cumbria bore the brunt of, saw 341mm of rain recorded at a Honister weather station in one day, more than a month's rainfall and a UK record (Glover, 2015). Within the resulting flooding debate, sheep were held responsible by some conservationists and commentators, yet it cannot go unnoticed that an increase in severe flooding throughout the UK in recent years has happened despite a dramatic decrease in sheep numbers, especially in hill and upland areas, since the CAP reforms in 2005. It must be acknowledged that some types of soil, in particular clay and mineral soils, can be caused to cap by the hooves of sheep – but on peat land soils, hooves can aid the breakup of the soil cap and increase the absorption of water into the soil. Designations such as sites of special scientific interest (SSSIs) have been known to prevent farmers from maintaining the waterways in their land, often with detrimental results. Every site in the UK is different, and so the need for site-specific solutions is essential for the best management. This is arguably why Defra announced in April 2016 that farmers in England could clear debris and maintain ditches up to 1.5km long on their land, following a successful two-year pilot. Plans for internal drainage boards and other groups to have more power in the maintenance of their local watercourses were also revealed, and simpler applications for environmental permits (Gov.uk, 2016).

Most major EU countries are experiencing increased flood risk due to the increased winter rainfall and irregular, extreme weather events that are likely due to climate change (Forest Research, not dated). The uplands generally experience greater levels of rainfall than their lowland counterparts and, coupled with their steep slopes and some habitats with low water storage capacity, they experience rapid run off impacting on floods downstream (Natural England, 2013a) – but many natural habitats found in the uplands, such as bogs, woodlands and moors, are natural flood defences, acting as 'giant sponges' to absorb and hold water and slow run off up to a point (The Wildlife Trusts, not dated). Many of the major rivers rise from areas populated by blanket bogs and, when in good condition, these release water slowly, reducing the height, effect and cost of flooding down-stream (The Wildlife Trusts, not dated). Well maintained woodland, scrub, mosses and heather are the most beneficial sources of vegetation for intercepting and impeding water flow (Natural England, 2001). When badly damaged their ability to store water is reduced, which is where measures such as reducing grazing and blocking old draining ditches encourages the regeneration of essential vegetation, sphagnum mosses and heather (The Wildlife Trusts, not dated). Established forests are also valuable for flood mitigation, using more water through interception than other vegetation types, although large-scale mono-species commercial plantings can cause severe soil erosion and water pollution at times of planting and harvesting.

SHEEP AND MITIGATION OF FLOODING

Work in Belford, Northumberland, by researchers from Newcastle University has meant a community once devastated by regular flooding has not seen the like since measures were implemented in 2010. Other than the obvious intention of reducing flood risk, the Flow Partnership project also aimed to improve the productivity of farmland, increase biodiversity and reduce pollution. Farmers within the catchment area were approached by the group and offered a payment to have the experimental measures conducted on their land. All of the farmers accepted, and it was their in-depth knowledge of the landscape that helped make the project successful. Most of the 26 measures implemented were low cost and will involve very little maintenance going forward, and the project remained well under its £2.5 million budget at around £200,000. The aim was to dissipate and hold back the water at the top of the catchment, where there is rough sheep grazing, to prevent flooding and damage at the bottom of the catchment, where there is housing and arable land. Bunds created ponds where water can be diverted, stored at high peak time and released back into the river when levels return to their natural states. Large wood structures slow the flow of water and divert it onto the floodplain. The local community are reported to be extremely pleased with the results of the trial, and the farmers rewarded with a 'feel-good factor'. Peter Brewis is one of those farmers. He says: "I was approached by Mark Wilkinson from Newcastle University to get involved in the project, after several flash floods affected the area. It was important the work had very little impact on the output of the farm, and we managed to find a number of areas that suited both of us, successfully holding water without affecting the farming, whether livestock or fields in arable rotation. There are plenty of suitable sites on the farm, using permanent pasture which recovers quickly after flooding, field corners of fields in arable rotation, and also woodland. These have all worked well. Not long after the first work was completed, Belford suffered a considerable storm but did not flood."



CASE STUDY

3.1 WATER MANAGEMENT & FLOOD ALLEVIATION *continued*

Woodland, forest and scrub all slow the passage of water with their deep network of roots and surface area of leaves. Some rainfall evaporates back into the atmosphere before ever hitting the ground (Natural England, 2001). The great surface areas of roots and leaves mean they absorb more water underground than grasses or other vegetation, and expel more back into the atmosphere through evapo-transpiration (Natural England, 2001). Their high water usage in the summer makes them drier, enhancing their soil ability to store water (Forest Research, not dated). The fewer rapid fluctuations in water flow mean less soil erosion and therefore less sediment load in watercourses further down the catchment (Natural England, 2001). Upland forestry has been promoted by some as a panacea for flooding in lowland areas, but it is unlikely to significantly affect the flood risk downstream on its own, as the effects are evened out at a larger catchment level (Forest Research, not dated). Flooding downstream can also be caused by inappropriate building development directly onto floodplains or on land that would normally aid the natural draining away of water. Poor maintenance or insufficient sewers and drainage will also cause localised flooding in downstream areas (UKELA, 2014).

It must be remembered that all sites are different and so solutions in areas affected by flooding will be different. In areas where there is little chance to slow down the water, the priority must be ongoing stream and river maintenance to get water away quickly. The removal of rocks and sediment will aid this, and also maintain spawning beds for fish. Non-intervention policies, such as those for streams and rivers in sites of special scientific interest (SSSI), go against centuries of human maintenance and are unsustainable; the answer is site-specific, flexible and sensitive maintenance to protect farmland and aquatic habitats. In other situations, flood mitigation can also be achieved through the maintenance of field drains, and the use of aeration equipment at appropriate times of the year, which aid grass growth and infiltration, reducing run off. Another option in areas where water needs to be controlled is riparian zone management, where a tree shelter belt is created along the water course to trap sediment and nutrients from run off. Willow is an ideal species of tree to use for this, as it is fast growing and has a dense root structure and wildlife value, but it is important to use a variety of species in case of disease (The Woodland Trust, not dated). The riparian bank stabilisation and habitat improvement work at Pontbren changed an eroding bank that was supplying sediment into the stream to a narrower and more heterogeneous bed profile with natural vegetation recovery (Smith, 2016). Further research is needed to find out how different ages and species of trees affects the water holding capacity and hydraulic properties of different soil types and conditions (Marshall, 2016). The work at Pontbren is an excellent example of the benefits of strategic planting of trees and hedges for the alleviation of flooding. One of the lead researchers from the Pontbren trial, Miles Marshall from the Centre for Ecology and Hydrology, stresses that planting trees is only one of many measures needed to mitigate flooding and 'is not the panacea to all flooding'. Once soils are already saturated, the effect of trees in aiding water storage space is greatly diminished. Current research, such as the Multiland Project led by Bangor University, is going further into developing an evidence base for positive interactions between trees, soil and livestock.

3.2 CARBON & PEAT

NSA believes upland and hill areas would benefit from:-

- **Recognition of the extreme importance of the uplands as carbon sinks, in particular peat soils, and the role that farmers play in protecting them.**
- **Recognition of the environmental and societal benefits of grazing and farming to reducing risks of wildfires.**

To help combat climate change, there must be a balance between carbon stored and atmospheric carbon dioxide on a global level (Savoury Institute, 2013). Carbon sequestration is a process by which carbon is taken out of the atmosphere by plants through photosynthesis and permanently stored in the soil, through live or dead plant material (Fenton, 2014). Organic soil carbon makes up 60% of the organic matter of soil (Savoury Institute, 2013). Upland peatland and peat soils are the largest stores of carbon in England, storing 138 million tonnes (Natural England, 2013a). Scottish peatlands contain 1,600mt of carbon (Scottish Government, 2010) equivalent to 200 times the annual Scottish greenhouse gas emissions (Scotland's Soils, 2016). In Wales, the Forestry Commission calculated 351mt of soil carbon at one peat site, but up to 400mt had been recorded using national mapping (Vanguelova et al., 2012). Peat in Northern Ireland holds 162mt of carbon (Cruickshank et al., 1998). More carbon is stored in UK peat than in the forests of Britain and France combined, a total of 42% of the UK's store of soil carbon (Moorland Association, 2016b). Normally, the amount of carbon sequestered increases in line with the amount of plant mass, until a steady state is reached. However, in the case of peat bog, more and more carbon can be stored as the depth of the bog increases (Fenton, 2014). Current moorland habitats may eventually succeed into peat-forming ecosystems and would store more carbon than woodland ever could in these areas (Fenton, 2014). As well as acting as a carbon sink, a healthy peat bog will attract a wealth of invertebrates and in turn support many wading birds. The ability of peat bogs to capture sediment reduces its build-up downstream, aiding fish breeding sites as well as benefitting other plant and animal life (Bangor University & University of Bristol, not dated).

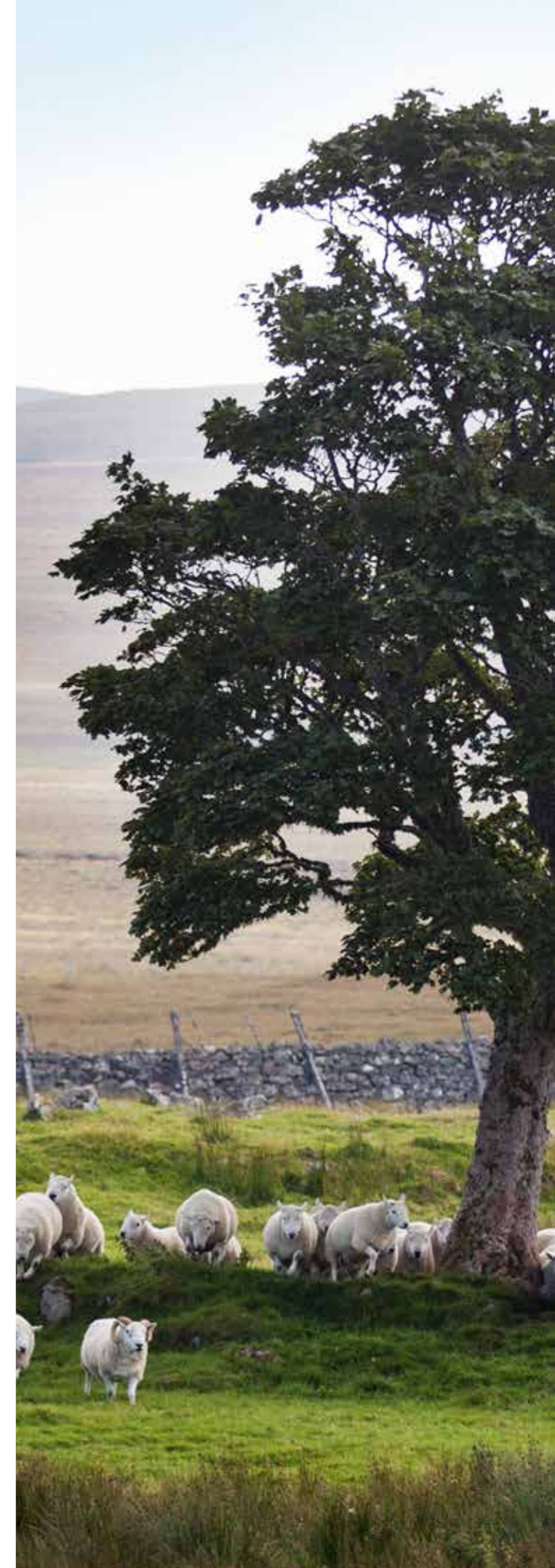
While it must be acknowledged ruminants are emitters of dangerous greenhouse gasses, it is the crudeness of carbon footprinting methods that suggest meat production on hill and upland farms has a higher environmental impact than its lowland counterparts. Current methods do not take account of the full carbon cycle and more holistic measuring tools are needed that look at more than just the fact the harsher climates and poorer quality grazing lead to reduced growth rates and lower productivity (Jones et al, 2014). Improving performance is often a main contributor to reducing carbon footprint, but this is recognised as a challenge within the delicate balance of farming and environment. It is important not to strive for improvements in isolation without considering the wider picture. However, there is potential for improvement in some instances, demonstrated by some of the top performing hill farms in the Jones et al (2014) study. Scenario analyses in a report by Hyland et al (2016) showed that by replicating the efficiency levels of the least-emitting producers, the carbon footprint of lamb producers could be

3.2 CARBON & PEAT *continued*

reduced by up to 30.5%. Selective breeding methods for improving lamb output per ewe, ewe productivity and growth rates (Jones et al, 2014) can be achieved by the use of estimated breeding values (EBVs) and genomic breeding values, an area that has great potential in the hill and upland sectors (Hyland et al, 2016). It is essential to try and close the gap between the poor and top performing farms in order to reduce the overall carbon footprint of the red meat industry (Jones et al, 2014). The emissions of nitrous oxide (N₂O) must also be taken into consideration. Accepting that dung from forage-consuming ruminants has a highly positive outcome for invertebrates, soil flora and fauna and higher life forms, ruminants are inefficient users of dietary nitrogen and up to 95% of their digested nitrogen is excreted (Selbie et al, 2015). Around 55% of hill sheep urine is deposited on 15-31% of the total land area, and the N-loading rate often exceeds the nitrogen requirement of the pasture (Selbie et al, 2015). The environmental and soil conditions have a strong influence on the release of N₂O, in particular it can be largely increased by the compaction of soil (Dijkstra et al, 2013). Dietary nitrogen has an influence on the amount of nitrogen excreted in urine, and manipulating this will be critical in reducing N₂O emissions and therefore gaining environmentally sensitive production (Dijkstra et al, 2013). Extensive hill and upland systems are far less reliant on nitrogen inputs from fertilisers and supplementary feeds, so dietary nitrogen is lower (Selbie et al, 2015).

Efforts by farmers and grouse moor managers to protect moorland habitats from over-grazing, erosion, bracken and wildfires help protect the carbon locked in the peat soils below (Countryside Alliance, 2012). This might include grip blocking, a method promoted by some Higher Level Stewardship schemes where drains previously created in the draining of uplands are blocked, allowing the improvement of healthy peat bogs, holding back water in the uplands and reducing risk of flooding downstream (Defra, 2010/2011). However, there is a fine balance. It is important to not over-wet the uplands, as ground that is too wet loses its capacity to hold water in times of heavy rainfall. Similarly, care must be taken when planting trees in peatland areas, as they can cause the peat to dry up and release the carbon back into the atmosphere (Fenton, 2014). A balance must be created between carbon capture and the drying of grassland for improvement, maintaining a moist optimum level, and the difference between peatland soil and peat bogs must be recognised, as despite the habitat advantages of peat bog, it is not suitable to sustain sheep grazing. It must also be noted that increased growth of *Bog asphodel* in boggy areas means flocks having to be moved or taken down from the hill (Bridgen, 2015), causing different land management challenges.

Grasslands also provide an effective, profitable and culturally relevant way of storing soil carbon when in optimal health (Savoury Institute, 2013). Grazing livestock greatly contribute to the improvement of soils, transforming bare patches into flourishing grassland biodiversity (Savoury Institute, 2013) when in balance with environmental conditions and season. Their hooves break up the soil cap of peat soils and trample the dead vegetation (which would otherwise interfere with new growth) into the soil, holding water there. Many agri-environment schemes require sheep to be removed from the peat soils of the hills at certain times of the year and onto the clay and mineral soils of the slopes and lowlands, which are easily compacted by hooves, increasing the likelihood of run-off in arguably the wettest season. Excrement and urine provide rich gut bacteria to fertilise the soil. The penetration of water, provision of nutrients and disturbance to the soil causes biotic activity and the circulation of gases, including carbon dioxide, and encourages growth of fresh vegetation where there was once bare soil (Savoury Institute, 2013).



NSA believes upland and hill areas would benefit from encouragement of farmers to control bracken responsibly.

Heather moorland is a globally threatened habitat, mainly due to over-grazing, afforestation and bracken encroachment, and is in fact rarer than rainforest. Blanket bog and upland wet heath are similar habitats, both providing excellent conditions for similar flora, but differ in the formation of peat. Dry heath contains little or no bog mosses at all (Durham Biodiversity Partnership, 2016). It provides habitat for a rich variety of flora and fauna and is of international importance, gaining the highest possible designations as special areas of conservation (SACs) for rare vegetation and special protection areas (SPAs) for rare birds. Of all the heather moorland left worldwide, 75% is found in Britain, largely due to its management by sheep and for grouse shooting but also providing habitat for many other species. Over the past 25 years, grouse moor managers in the north of England have regenerated and recovered 217,000 acres, with 57,000 acres in the last 10 years alone, and spend around £52.5 million on management costs every year. Much of this is privately invested and also benefits the economies of local rural communities. The industry supports 1,520 fulltime equivalent jobs, 820 of which are through associated services, such as game dealers, accommodation and equipment suppliers, which also benefit from an additional £15.2 million a year (Countryside Alliance, 2012).

UNINTENDED CONSEQUENCES OF UNDER-GRAZING

NSA member Hamish Waugh farms in the Westerkirk area of Dumfriesshire, Scotland. He has provided this image showing an area of ground where there is clear heather growth. The area to the right, which is the other side of a fence, was once grazed at around one ewe per 2.5 acres as part of a 1,200 ewe enterprise on 1,200ha (3,000 acres of land). Hamish says: "The sheep were removed from this patch around 28 years ago and it is clear the heather re-growth has been poor, if any at all. The land to the left of the fence is still grazed at a rate of one ewe per two acres and the heather here is knee-deep. I believe this shows the effect of under-grazing from the partial or total removal of sheep is not always what is desired. Grazing sheep on the sward at a suitable stocking rate for that unique area, to maintain and even flourish the heather and other vegetation, is the most beneficial option for all aspects of the biodiversity and environment."



CASE STUDY

A good working relationship and balance between all stakeholders on heather moorland is essential.

For example, grouse moorland managers creating laneways has allowed hill farmers easier access to areas that were previously hard to reach or even totally inaccessible (Moorland Association, 2016a). A loss of productivity of heather stands would cause a reduction in the numbers of sheep and an increased risk of natural fires (Wenzel, not dated). Managed heather provides a habitat for a unique assemblage of wildlife, with older heather for nesting cover and newer shoots providing food. Unmanaged heather becomes a dense mass of woody stems, a fire risk that supports very little wildlife and has no economic or grazing value (Countryside Alliance, 2012). Burning heather creates a mosaic of nutritional grasses and shrubs, encouraging grazing sheep to spread out and reducing damage from trampling and localised over-grazing (Moorland Association, 2016a). The short term negative effects of burning on the ecosystem are outweighed by the long term beneficial effects to management of the sites. Many nature conservationists would like to see longer burning rotations to help increase the biodiversity, but this would be detrimental to overall moorland management.

Bracken as a dominant monoculture negatively impacts a variety of sectors in the uplands through its loss of grazing or farming land, wildlife habitat, suppression of young tree growth and heather, and toxicity to animals (Wilson et al, 1998). It smothers more sensitive and ecologically valuable habitats (Heather Trust, 2013) such as heather moorland, by blocking out light and rainfall with its fronds, preventing other species from thriving or establishing (Bracken Control, not dated). The warm, moist habitat bracken creates is an ideal habitat and breeding ground for dangerous ticks (Bracken Control, not dated & Heather Trust, 2013). An increase in tick numbers has been linked in some areas to the spread of bracken and the associated increase of tick-borne diseases in birds, wildlife, livestock, pets and people. Bracken also reduces the land available for grazing, makes it difficult for farmers to gather stock (Bracken Control, not dated) and can render land ineligible for the Basic Payment Scheme (NSA, 2015). It causes health problems in sheep, such as tumours, ulceration and 'bright blindness', and is also carcinogenic, linked to increases in gastric cancers in humans (NSA, 2014). The main health risks to humans are associated with the inhalation and ingestion of bracken spores (Wilson et al., 1998). Some of the toxic compounds found in the spores are water soluble and so toxins leaching into water sources are a possible cause of harm to humans (Wilson et al., 1998). The millions of spores shed by the plant in summer, particularly in hot and dry conditions, can be transported long distances by wind; during this time it would not be unusual to find some concentration of spores in the air over most areas of Britain (Wilson et al., 1998).

Increased temperatures attributed to global warming have given rise to an increased encroachment of bracken at a rate of 2% per annum across the UK (Wilson et al., 1998). Traditionally a shepherd would cut bracken alongside the sheep, so the control of bracken was greater when more people worked the land. Nowadays grazing sheep are one of the management options for controlling bracken, alongside mechanical and chemical routes. To this end, tailor-made agri-environment schemes for different habitats to allow winter grazing would have great benefit to the control of bracken. Any activity to control bracken is encouraged to first consider any protected areas or species that may be affected, watercourses, restrictions in agri-environment schemes and any necessary environmental impact assessments that may need to take place (NSA, 2015). Chemical control is using asulam herbicide, which has been on the EU's non-approved list since 2011. However, through the industry-led Bracken Control Group, the UK has successfully obtained an annual Emergency Authorisation to use asulam between July and October, with strict rules about use and storage (NSA, 2015). Aerial spraying of the product must also be authorised with a permit from the Chemicals

Regulation Directorate (NSA, 2015). Sheep come into their own post-treatment, by trampling fronds that have survived spraying, such as young fronds growing below the surface, and increasing the rate of breakdown of dense bracken litter. Cattle and ponies can also do this, but are more damaging to other vegetation than sheep (Roberts et al., not dated). Getting the right balance of sheep grazing on bracken infested land can increase the benefits to plants and wildlife (NSA, 2014). Re-establishment of more species-rich grassland can support twice as many summer grazing sheep and, if applied across 1.5 million acres of bracken in the UK, could provide summer stocking for an extra three million sheep (NSA, 2014).

CONTROLLING BRACKEN WITH SHEEP

NSA member Geoff Eyre has observed some changes in the landscape of the Peak District since the reduction in sheep numbers. He says: "Areas where sheep used to bruise bracken fronds in their search for grasses underneath, slowing the return growth of the bracken, are now becoming dense bracken beds, upsetting the movement of sheep and causing other areas to become over-grazed." The image shows a grazed strip which prevented a wildfire spreading any further through a bracken bed. With regards to effective control of bracken, Geoff says: "It is important that any bracken control schemes stipulate follow-up control plus introduction of other species of vegetation, as spraying only sees the return of bracken many years later. If there is no grazing it returns far faster." Geoff uses controlled grazing as part of his bracken control scheme, and now sees a mixture of grass and heath plants where there was once impenetrable bracken. The sheep are able to graze off any emerging bracken fronds, keeping continued control over its growth and eliminating the risk of wildfire in drier weather. Geoff continues: "Reducing bracken on my farm has seen walkers enjoying the scenery rather than walking down once-green footpath corridors or sheep tracks. I can now summer-graze one sheep to the acre on land that was impenetrable bracken – and the rest of the moorland habitat and its wildlife is benefitting".



CASE STUDY

Incentivising bracken control could also take into consideration alternative uses for the plant. Bracken has never been part of the traditional human diet in the UK, as it is in some countries, but it was traditionally used for a variety of products, including winter animal bedding which was then spread back on to the land in the spring. Modern uses are currently very niche, such as bracken being utilised as a potash and trace element-rich fertiliser, combined with low grade sheep's wool for improved water retention and slower release of nitrogen (Dale Foot Composts, 2016). There are also a small number of briquettes made, which are 100% dead and dried bracken for domestic burning, claimed to burn hotter than oak and be a sustainable alternative to cutting trees for fuel (Brackenburn, 2016).

3.4 BIODIVERSITY & OTHER SPECIES

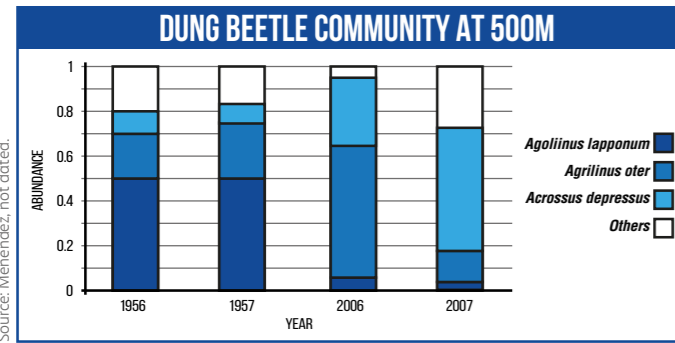
NSA believes hill and upland areas would benefit from:

- **Recognition of the value of sheep grazing to ecology and biodiversity.**
- **Site-specific grazing prescriptions and exploration of outcomes approaches, as there is no such thing as an optimal grazing level for all habitats and different seasons/weather require flexibility.**

The uplands hold a complex mosaic of habitats, each requiring different grazing regimes in order to maintain optimum structure and composition. Much of this has been highly influenced, if not created, by livestock grazing (Cumulus Consultants Ltd) which can control the growth of more aggressive plant species (English Nature, 2005). Grazing allows for a more gradual removal of plant material than cutting or burning, and gives mobile wildlife species the chance to move through the habitat (English Nature, 2005). Trampling also creates gaps in the vegetation to allow new seedlings to grow (English Nature, 2005). In a study by Hill & Beinlich (2000) sheep were highlighted as important vectors in the passive dispersal of taxa such as snails and grasshoppers, which would otherwise have low individual mobility. The fragmentation of some natural landscapes, due to a combination of intensification in some areas with the decline of traditional farming practices in others, means some local populations of taxa are becoming critically low. In one summer, 13 species of grasshopper and four species of snail were recorded in the wool of one sheep, with the maximum distance recorded for a grasshopper being 700m, much further than its normal home range. There were also a total of 133 plant species found, either in the wool or claws of the same sheep, some remaining on the sheep for up to four weeks, translocating by up to 100km.

Many bird species benefit from sharing their habitat with grazing sheep, including using naturally-shed wool as sturdy nesting material. Habitat diversity supports species that prefer long or short vegetation or rely on the interaction between the two. Song birds (passerines) in particular prefer the heather mosaic that sheep create by their natural grazing behaviour, and are more commonly found in areas where there are more sheep (Irvine, 2011). The situation reverses when under-grazing results in the encroachment of tall, coarse grasses in many areas, changing the vegetation structure and adversely impacting on bird species such as golden plover and other waders (Cumulus Consultants Ltd, 2012). Increased cover from under-grazing gives predators better opportunity to eat the eggs of ground nesting birds and decreases the accessibility for young chicks. Off-wintering of sheep decreases the habitat diversity for birds as there are less safe places for nesting (Edwards, 2006). The removal of sheep from the hill pastures, and intensified use of in-bye land as a result, has led to a loss of floral diversity and structure for nesting birds, such as lapwing and skylark (Cumulus Consultants Ltd). A reduced level of grazing or total cessation has shown an increase in more competitive species, like tall grasses and rushes, and a decrease in shorter grasses often as a result. This has been shown to reverse the beneficial effects of relaxed grazing pressure on some invertebrates and moorland birds, as dense swards compromise their mobility and access to prey. Some species of moth of conservation interest thrive in heavily grazed situations and skylarks are also benefitted from short vegetation. Many

other species benefit from the tussocky and contrasting structure of vegetation associated with grazing. The removal of grazing and therefore the removal of dung inputs to the soil and altered character of plant litter, have also been shown to reduce microbial biomass and nutrient cycling (Martin et al., 2013).



Source: Menendez, not dated.

Invertebrates, flourishing from the reproduction sites in sheep dung, utilise the plant diversity maintained from effective grazing regimes as an excellent food source (Irvine, 2011). Beetles and their grubs are in turn an excellent food source for birds and some mammals. Dung beetles eat droppings, potentially containing parasites harmful to livestock, and so help maintain a clean pasture. Their burrowing into the soil aerates it, allowing nutrients and rainwater in and promoting healthy grass growth. Scotland is a stronghold for three species of dung beetle, in particular the Cairngorms and Western Isles (McKenzie, 2015). The northern dung beetle (*Agolinus lapponum*) is abundant in the uplands of the UK, in particular Scotland, the Peak District and Snowdonia, strongly associated with sheep grazing. The population of the northern dung beetle has dramatically declined since the 1950s (Menendez, not dated). One of the main reasons for this decline is the changes in farming practices, particularly less grazing livestock on historic pastures (McKenzie, 2015).

Over recent years, there has been a huge increase in cases of Lyme disease in humans, of which ticks are the main vector. Experts blame the rise on a number of factors, including climate change (particularly warmer winters) and increased housing development in rural areas (Donnelly & Harley, 2015). Ticks thrive in vegetation where there is sufficient humidity to stop them drying out, in particular bracken found in woodland, moorland and rough pasture (Smallholder, 2015). There is a complex transmission system in the uplands for louping ill, passing between sheep and group, exacerbated by mountain hares and deer (Irvine, 2011) and if sheep numbers were to further decline reduced competition would result in an increase in one, if not all, of these populations and therefore an increase in population of ticks. Sheep are an important tick host, and while having natural immunity to Lyme disease (Smallholder, 2015) they can transmit and suffer mortality from louping ill virus (Irvine, 2011). By adding sheep that are regularly treated with chemical pour-ons and dips to the environment, the amount of ticks present can be reduced (Pakeman, 2011).

At the extreme end of the push for reduced stocking rates is land abandonment. The idea of land abandonment can be split into three definitions: actual abandonment, where farming ceases and vegetation takes a natural succession into tall grass and eventually forest ecosystems; semi-abandonment, or hidden abandonment, where land remains subject to the most basic form of management in order to qualify for the current Basic Payment Scheme; or transitional abandonment, as a result of restructuring, land reforms, compulsory set-aside until it was abolished in 2008, or land use change (Scottish Government, 2015). Destocking or reduced management in the UK has commonly led to semi-abandonment, where the land is still viable for future use but is in real danger of actual abandonment. Certain factors contributing to the abandonment of farmland, be it actual or semi, include the distance from roads, retirement and lack of succession, low support payments and climate (Scottish Government, 2015). Unlegislated 'land sparing' is occurring in parts of Eastern Europe due to intensified use of other land in receipt of CAP support payments (GB. Parliament, 2012). Without enough conclusive evidence it is hard to decide how best to conserve areas of the UK that have a long history of agriculture, high population density and little remaining semi-natural habitat (GB. Parliament, 2012). In order for some land to be 'spared', other land would have to become even more intensified, arguably defeating the object. In Scotland, there has been significant destocking since 1992, predominantly in the lowest funded LFA, with numbers of breeding ewes falling by up to 42% in some areas (Scottish Government, 2015). One of the main reasons for this is the move from a permanent, local agricultural workforce to a more casual trend of employment, often bringing in workers who do not live in the areas all year round (Scottish Government, 2015). The total agricultural workforce in Scotland is down by 3% compared to 1992 but the number of casual workers has more than doubled (Scottish Government, 2015). Overall, 73% of upland farms do not employ any non-family labour (Thompson, 2009).

It is also important to consider the role of the human in biodiversity, as the potential for rural depopulation increases with a decline in the sheep farming of the hills and uplands. As much as we do not want to see the extinction of ground nesting birds or fragile upland flora, we also do not want to see the extinction of the shepherd, surely one of the oldest occupations. With such a large sheep population in this country, and sheep farming being threatened throughout Europe, protecting the UK shepherd is an activity of international significance.

NSA believes upland and hill areas would benefit from:

- **Trees and valuable areas of scrub within grazing areas no longer being classed as permanent ineligible features (PIF) under the Basic Payment Scheme or its post-Brexit successor.**
- **Resolution of contradictions between the Basic Payment Scheme and agri-environment schemes, and steps taken to ensure no such contradictions exist in post-Brexit schemes.**

NSA is supportive of the integration of trees into some types of farmland, seeing this as preferable to block planting and removal of land from agriculture. Integration will not work on every farm but, in the right place, has a role to play. NSA has a joint publication with the Woodland Trust on 'The role of trees in sheep farming' (2014) discussing how trees can provide production, health and welfare gains for sheep, and environmental benefits, and are a key part in the regeneration of the upland environment. As many of the hardy flocks of the hills and uplands are adapted to lamb outdoors, the creation of a shelter belt of trees would provide ideal shelter, helping to reduce lamb losses from exposure by up to 30%. It also gives the ewe the opportunity to seek isolation when lambing, a key factor in the development of mothering ability and bonding with her lambs, boosting survival rates. By reducing wind speed, shelter belts also reduce evapo-transpiration from the grass and increase the soil temperature, meaning continued grass growth for an extended amount of time. Most importantly, the addition of shelter belts does not take large tracts of land out of production and, with the exception of land eligibility for the Basic Payment Scheme (more on this later), the loss of productive land can be minimal.

MAKING TREES WORK ON FARMLAND

Roger Jukes is among several farmers involved in the Pontbren project in Welshpool, Powys, which is a partnership approach to integration of trees and hedges for the alleviation of flooding and beneficial to livestock production. He says: "Since the early days of the Pontbren project to the present day, our main driving force was not only the creation of natural habitats for wildlife but also establishment of natural barriers to give livestock protection from the harsh climate we endure in our region. The project showed agriculture as a business can work side by side with the aims of biodiversity enhancement, preservation of natural habitat and protection of water quality. We also created affective partnerships with the likes of Coed Cymru and CEH, which did extensive research work on how planting trees can also be part of the solution for protection against flooding in other areas in the future." Gwen and Aled Morris of Tynfron are also part of the project. Mr Morris says: "Our farm benefitted as natural shelter was created with the creation of new hedgerows. Existing woodland was fenced off and only coppiced when reaching maturity. Waste timber was chipped and used as bedding for livestock and then used as compost. Our farm is very exposed and, by regenerating old hedgerows and protecting woodland already on the farm, we ensured natural protection against the elements."

Planting trees can help reduce the incidence of common flock health issues, such as liver fluke, lameness and mastitis. Fencing off wet areas and allowing them to regenerate into ponds or bogs greatly improves the biodiversity and also reduces the likeliness of liver fluke in sheep. If sheep cannot graze areas of bog, the bog remains in good health and they are prevented from ingesting the toxic *Bog asphodel* plant (Bridgen, 2015).



Planting trees also encourages water infiltration into the soil, therefore reducing the wet areas favoured by the hosts of the fluke parasite. Poorly drained and severely poached areas of land give rise to the incidence of lameness in sheep, as an ideal breeding ground for bacteria. Bacteria can also cause mastitis when transmitted into the udder through sores from suckling lambs. The reduction of cold, harsh winds by shelter belts can potentially help in the prevention of this too. Farmers wishing to operate a closed flock can benefit from tree planting, increasing biosecurity by making it harder for sheep to have direct contact with neighbouring flocks. Trees can also improve water quality and reduce flood risk to lower-lying areas, increase biodiversity and produce of wood for use as fuel or an alternative livestock bedding. Trees do all this while also being a key player in the sequestration of carbon, absorbing it and locking it into the soil, with young trees able to soak up more carbon than mature trees (Forestry Commission, 2014).

Despite the benefits of the integration of trees into the farmed landscape, farmers are understandably nervous about the loss of payments from taking land out of productivity. This is one way that the UK could benefit from having to adopt its own agricultural policy outside the EU, as a more holistic system could be put in place so, where sites are identified for improvement through tree planting, barriers for farmers to enhance biodiversity and assist with water management are removed. McCracken (2015) explains that planting trees can not only provide environmental and livestock benefits, but also an additional income stream for farmers, expanding into the timber industry and aiding resilience against economic shock, without detracting their energy and efforts too much from maximising their livestock performance. However, UK farming and forestry are often seen as mutually exclusive, unlike in the Black Forest in Germany, for example, where it is second nature to integrate the two. Being able to do this, particularly in Scotland, would meet the timber demand and climate change mitigation targets from the Government (McCracken, 2015).

When it comes to already-established trees, grazing behaviour of sheep is beneficial to the diverse habitats found in niche areas of ancient semi-natural woodland, and sites where sheep have been removed have suffered from a reduction in species diversity (Mayle, 1999). Sheep help create and maintain habitats for the invertebrates and vertebrates alike, which depend on the ground flora and shrub layers of these areas (Mayle, 1999). The trampling of sheep hooves is 44% less than that of cattle, providing pathways for other mammals and birds, creating seedling establishment sites, and reducing the spread of bracken (Mayle, 1999). Finding the balance is critical, as using sheep to control more invasive and competitive plant species, such as bracken, prevents the shading out of ancient tree species, while some bare patches of ground reduce the competition for new seedlings (Mayle, 1999). Bursts of tree regeneration have been observed when grazing is relaxed, thanks to the good germination sites they have provided (Fenton, 2013a). Maintaining moderate levels of grazing in woodland is ideal for creating species-rich, structurally diverse habitats (Mayle, 1999). Fenton (2013a) observed that the better soils here allow for the natural colonisation of prickly shrubs, brambles, hawthorns and sloe, letting the trees regenerate without being eaten. Also the wintergreen herbage found here is palatable to the sheep, taking the pressure off tree browsing (Fenton, 2013a).

3.6 SEMI-NATURAL HABITATS

NSA believes upland and hill areas would benefit from:

- **Easing of licences for control of problematic protected species, such as badgers, ravens and sea eagles, to a level that keeps farming and wildlife in balance.**
- **Recognition that the UK has very little truly wild landscape, instead the landscape, wildlife and ecology seen today is a result of thousands of years of farming.**

The rural landscape of Britain so well known and loved by residents, visitors and tourists, writers and poets, artists, photographers and even musicians, from all around the world, is mostly as a result of man-made intervention, communities eking out a living and pastoral-type farming based heavily on the grazing of livestock. Wildlife and ecology have evolved to live around this human activity and rewilding on any scale would cause an imbalance in what, at its best, is a symbiotic relationship with ecological sustainability. Britain is a small island with a high population and one that is reported to be growing faster than any other EU nation (Barrett, 2015). It cannot accommodate the vast areas of wildness sought after by some environmentalist groups. For example, the Lake District covers an area of 2,292km², but the Denali National Park and Preserve in Alaska is an astounding 24,584km² in comparison (National Parks, not dated). Habitats would not be able to return to their original wild state, only develop from their current starting points, so there is a misconception behind the rewilding premise (Chesterton, 2009b).

An assumed practical interpretation of rewilding may be more of a concept of minimum intervention, with the use of free-ranging large herbivores and possible species reintroductions, as opposed to true abandonment, where there are no farming or forestry activities, no human intervention and no support payments (Chesterton, 2009b). But to remove humans from the ecological chain is neither practical nor desirable and does not recognise the role of humans in ecology. The loss of traditional farming practices to accommodate re-wilding has caused feelings of being undervalued and unwanted amongst farmers (Thompson, 2009). This is supported by Fenton (2015), who describes the idea of rewilding as a highly emotional concept, rather than being based on a scientific understanding of local ecology, and one that will change a natural habitat into a 'designer' one. Historically, Britain's woodland areas were in decline while wolves and other predators still populated our landscapes, and before the introduction of large scale sheep farms, so sheep are not to blame for the reduction of woodland, and the reintroduction of predator species will not help regenerate it. When the Domesday Book was completed in 1086 it put England's forest cover at 15%, although there are no records for Scotland and Wales at this time (Forestry Commission, 2015a). Nearly a thousand years later, at the start of the new millennium it was calculated that Britain's forest cover was around 12% (9% of England, 16% of Scotland and 12% of Wales)

(Forestry Commission, 2015b). Much of the rural landscape that we see today was thought to have been established by the time of the Magna Carta in 1215 (Forestry Commission, 2015a). Fenton (2013b) argues that human intervention of the current landscape by adding trees reduces its naturalness and conservation value. He argues that trying to link woodland habitats for the benefit of wildlife destroys the linking habitats for moorland wildlife, and that planting trees in peat soils will dry them out, releasing carbon into the atmosphere.

FARM TOURISM WITHIN A NATIONAL PARK

NSA members Robert and Sarah Helliwell farm Swaledale sheep and Belted Galloway cattle in the Peak District National Park. They are tenants of the National Trust. Robert is a member of the Peak District National Park Authority and Sarah is a local. Robert says: "Sheep grazing has and continues to provide a means of sustainable utilisation of the coarse vegetation on the moors, while producing quality meat, wool and hardy breeding stock. Without this close grazing the ingress of scrub is soon apparent with a subsequent change in diversity and a change to the much valued landscape." Some of the estimated 16 million annual visitors to the Peak District stay at Robert and Sarah's campsite, and often want to know more about the landscape and wildlife that have been created by years of predominantly sheep farming in the area. Many other farms in the National Park also rely on tourism to help balance the books, and keep in mind that each visitor is a potential customer of UK agriculture. But with the benefits of the many visitors to the area also comes problems. Visitors with dogs present a huge issue, both the behaviour of dogs out of control, and the lack of disposal of plastic dog waste bags, which are not degradable. General litter is a constant issue, and insensible parking of cars which has even resulted in emergency vehicles being restricted in their access. Robert has found that the common problem of visitors leaving gates open can be helped by using gates that close and latch easily, but this is up to the farmer or land owner to ensure. The Countryside Code promotes 'respect, protect, enjoy' as a reminder that rights come with responsibilities, and many feel that awareness of this needs to be increased in the public eye. He adds: "Sheep farming has been a major element in the creation of the Peak District landscape over many years. It would be interesting to see in 400 years' time what lasting landscape features result from the mass influx of visitors to the area."



CASE STUDY

In a country as densely populated as the UK it is important for physical and mental wellbeing for urban dwellers to have access to the countryside. Public access is widespread throughout the UK, complemented by the 10 National Parks in England, three in Wales and two in Scotland. The designation of National Parks aims to protect and conserve the area concerned and, while they often designate areas of special interest they have received some criticism from businesses due to influence over planning controls and through applying restrictive development opportunities. While careful planning controls are important, stifling proportionate development threatens farm businesses and risks damaging the natural evolution of traditional landscapes and the people who live and work in them; it risks creating museums rather than a living landscape (Chesterton, 2009b). The idea that such areas are a 'park' with 'national public rights' often leads to environmental damage, disturbance to wildlife and damage to farm properties and livestock. An increasing incidence of dog attacks on sheep is a prime example of this. The people who live and work within these areas often foot the bill for any damage and liability claims, and while some businesses can benefit from increased visitor numbers, others are inconvenienced. The majority of land is privately owned (National Parks, not dated), so although referred to as National Parks they cannot be categorised as this by International Union for Conservation of Nature (IUCN) standards, as they are places where people live and work. Instead, they are IUCN category V 'protected landscapes' shaped by nature and people over thousands of years and protected to conserve natural and cultural heritage (National Parks, not dated). Areas of outstanding natural beauty (AONBs) promote places of landscape, heritage and biodiversity beauty, and encourage visitors to understand the value of living rural communities with fewer restrictive controls on farmers and land owners than National Parks.

Within the rewilding debate, special reference should be made to the current proposals to release the Eurasian lynx to the UK. NSA has completed a review of these proposals, which are to obtain a licence to release six adult lynx on one of three possible sites for a five-year trial period. NSA did not find any tourism benefits, as the lynx is such a shy animal, and concluded that sheep farming and its related ecology would be at substantial risk if the proposed scheme went ahead, with sheep seeking shelter at woodland edges being exposed to predation from the lynx. The welfare of sheep would be hugely compromised due to fear and distress of predation, protecting their lambs and the obviously maiming and deaths that would ensue. This would undermine the UK's 'A' rating worldwide for its farm animal welfare, something that farmers strive to maintain in their daily work (NSA, 2016). Another important feature of UK farming is the strict legislation for the safe disposal of carcasses, to reduce the likelihood of disease. A large predator ripping apart carcasses and transporting body parts will jeopardise all efforts farmers make towards biosecurity measures (NSA, 2016). A further reduction in sheep numbers from predation by lynx would do nothing to help the biodiversity in upland areas provided by sheep. Additionally, the ability of a population of Eurasian lynx to be genetically resistant and sustainable given the UK's dense population and urban infrastructure is highly questionable. NSA is concerned the lynx would be introduced as a protected species, adding to problems sheep farmers are already have with the lack of licensing to control problematic populations of ravens and sea eagles.

Although not directly related to rewilding, the term High Nature Value (HNV) farming is another approach being promoted by conservation bodies. This concept appears more advanced in other parts of Europe, due to its potential to offer market opportunities for products produced in harmony with special semi-natural habitats. It could arguably do this in the UK, particularly to differentiate some of our rarer and heritage breeds from global commodity products, but NSA feels many hill and upland farms are already functioning as high nature value farms and that any HNV scheme should be inclusive and not just to cater for extreme conservation approaches. The Scottish Government recognises this and describes more than 40% of land (2.3-2.4m ha farmland and 1.4m ha woodland) as being High Nature Value (Scottish Government, 2014). Many of the sought-after features, such as hedgerows, field margins, walls and wetlands (Thompson, not dated) are often already naturally occurring on these farms or prescribed as part of existing agri-environment schemes.

Farming people are an important but decreasing part of rural communities, and their falling numbers mean changes for the character of rural life (FACE, not dated). Populations of rural communities are increasing with people moving out of urban areas, who have different ideas on how the countryside should be, affecting its shape and giving less influence to farmers. The farmers that remain are under increased pressure, experiencing lower returns and a poor public image, are less likely to participate in community life, further distancing themselves from the rest of the community (FACE, not dated). Despite a rising trend in farmers reporting feelings of isolation, upland farmers experience most frequent contact with other farmers (Thompson, 2009). Demand for rural housing from outside the area, particularly for affluent retirees and second/holiday homes, has increased house prices making it more difficult for young local people to find affordable places to live and making retirement for farmers and farm workers a challenging decision. This contributes to driving young local people out of local area to look for employment and affordable living, and reduces acceptable retirement options for older farmers.

If young people can be encouraged to stay in the area and involved in agriculture, through innovative and educational support schemes, the industry will continue to flourish and traditional methods and heritage can be preserved in the best way possible. Providing existing farmers with the business skills to improve their farming establishments and to diversify in different ways can also enhance their returns for now and the future generation. Tourism is a huge industry, particularly linked to the breath-taking landscapes of the hills and uplands, and there are great gains to be made from farmers diversifying into the tourism sector in their local area where appropriate.



NSA believes upland and hill areas would benefit from:-

- Proportionate easing of planning regulations, particularly in National Parks, to encourage and allow investment and appropriate energy-generation projects.
- Improved broadband access and mobile phone coverage, to allow resource access and facilitate diversification.
- Recognition of the multiplier effect and how farm enterprises support many other local business and services.

Tourism and recreation is reliant on the countryside being a managed environment, as visitors come to see the landscape, views and long, clear vistas. Tourism would be negatively affected if the landscape was unmanaged and the landscape became blocked with trees and scrub, and recreation opportunities would be limited without easy access. At least 86% of the open access land in England is found in the uplands, attracting 40 million visitors and making £1.78 billion for the local economies every year (Natural England, 2013a). In 2014, rural Wales saw 19m day visits and 2.28m overnight stayers (The GB Tourist, 2014), spending a £674m and £367m respectively. The Scottish countryside saw 2.64m overnight stayers and 26m day visitors (The GB Day Visitor, 2014). Often visiting from the lowland, be it urban or rural areas (CPRE, 2012), visitors come to seek inspiration, recreation, exercise and well-being, enjoyment and spiritual solitude, through a variety of activities from walking, climbing, caving or horse riding, to hand-gliding and four-wheel-drive experiences (Natural England, 2001).

It is important for rural communities to establish an alliance between their own aims and the interests of their visitors, and the farming community is arguably the most significant stakeholder as it earns a living directly from the land, is resident year round, and supports local services and businesses on an ongoing basis. It is important to not put these areas of special interest at risk, and therefore education and a greater understanding of the local environment can be provided by visitor's centres in key places, such as carparks, while still managing public access (Natural England, 2001).

There is a total of 225,000km of footpaths in England and Wales. In Scotland the 15,000km of pathways (Parkinson, 2015) have been superseded since 2005 by most land becoming open access to walkers abiding by the Open Access Code (Scottish Outdoor Access Code, 2005). In Northern Ireland there are very few rights of way and so most walkers rely on the kindness and trust of landowners in order to explore the countryside. WalkNI (2016) provides a list of 'quality walks' totalling 1,566km of footpaths. The 15 National Parks in England, Wales and Northern Ireland amount to a total of 2,265,800ha. The importance of the health benefits from contact with green space and the natural environment, or 'green exercise', is highlighted in the report by Pretty et al. (2007). The trial found that no matter the intensity, duration or type of activity, green exercise led to significant improvements in self-esteem and total mood disturbance. One in four people each year are now affected by a mental health issue and the prescription of anti-depressant drugs increased by 165% between 1998 and 2012 (Bragg & Atkins, 2016). Obesity and related illness are a greater cost to public health than smoking (Pretty et al., 2007) and costs the taxpayer more than the fire service, police and prisons combined (NHS, 2014). Creating a fitter and more emotionally content population would reduce the individual human suffering and cost less to the economy (Pretty et al., 2007) and this can all be achieved to the benefit of the uplands and hills. In fact, residents of rural areas have better mental and physical health than their urban counterparts (Thompson, 2009).

GROWING TOURISM THROUGH ICONIC LANDSCAPES

Tourism massively suffered in Northern Ireland as a result of the Troubles, but began to improve following the 1994 ceasefire. In 1995-2005 visitor revenue increased by 61% to £220m, despite only 18-21% of the 1.967m visitors being tourists (rather than visiting family) (GB. Parliament, 2007). The Northern Ireland Tourist Board developed five signature projects aimed at international tourists, including the iconic rural landscapes of the Giant's Causeway and Mourne Mountains. In 2015, 70% of hotels and 47% of attraction providers saw positive increases in visitors from the previous year and car hire and coach operators expecting to see a 100% increase in business from 2015 to 2016. Bringing the television fantasy drama 'Game of Thrones' to Northern Ireland, filmed at several urban and rural locations, has seen a return of £12.45m and provided £110.7m to the economy through goods and services, including guided tours (Meredith, 2015), and created 900 fulltime and 5,700 part time jobs (Farrell, 2015).



CASE STUDY

The overall UK shooting industry is worth £2 billion to the economy, with shooters spending £2.5 billion a year on goods and services. They provide vital income to the rural food and accommodation sector during the autumn and winter months when tourism is substantially reduced, often meaning the difference between profit and loss for some businesses. Shooting supports the equivalent of 74,000 full-time jobs, 5,200 of which are in the food and accommodation industry, and the conservation provided by shooters equates to 16,000 full time jobs, at a cost of £250m a year through work done by shoot providers (PACEC, 2014). Scotland's game shooting industry provides 16,300 full time equivalent positions and is thought to be worth an annual £240m to local economies (Irvine, 2011). Around 16% of the uplands are managed as grouse moors for the traditional northern uplands recreational activity of grouse shooting (House of Commons, 2011). Red grouse and red grouse shooting are indigenous to Britain, meaning there is global competition to secure and manage the best grouse shooting (Natural England, 2013a).

THE MULTIPLIER EFFECT

The Lilburn Estate Farming Partnership sheep enterprise comprises 12,000 ewes across lowland and hill flocks in Northumberland. The contribution to the local economy is vast, through employment of local people and labour from further afield. For example, a local scanner is employed for six weeks to help with lambing at around £1,000 a week, which giving him money to take back and spend on his own farm. Similarly, Lilburn employs three full-time hill shepherds and six part time shepherds, most of who are local farmers earning money to help their own farm enterprises. Some shepherding help also comes from Scotland, usually for around six weeks, who stay in B&B accommodation and spend money in the local pub and shops. Lilburn also uses a Scottish shearing firm for 5,000 ewes, who would spend money in the local amenities, and a local shearing firm for 7,000 of their ewes, employing local people. At lambing time there are also six students from Wales, who earn £600 a week for six weeks, learning the essential skills of lambing and sheep husbandry. Dominic Naylor, Lilburn Estate Farm Manager, explains: "Without the CAP support, 22 people would lose their employment from the sheep enterprise, eight of which have two or more children at the local school. If more jobs were lost on the wider estate, this would include a further eight people with children in the local school. The effects would ripple into the local economy if these families were forced to move away from the area as a result of their job loss."



CASE STUDY

The multiplier effect of farmers paying back into the local economy is of great importance. Farming supports other industries such as feed, fertiliser and machinery merchants, vets, hauliers, abattoirs and auction marts. In a report by Marsh et al (2012) it was found that 34,000 people were employed on English sheep farms, supporting a further 111,405 jobs in allied industries and contributing a value of £291.4m to employment. Farmers and farming families recycle money in the local community by using local shops and businesses, by using local amenities such as transport, church halls and schools, and being part of local councils and committees. Farming families are often the backbone of rural communities, and it is the upkeep of the services that rural communities can provide that pays off during the tourist season. Many upland sheep farms are reliant on direct funding from the EU Common Agricultural Policy, but this money is recirculated amongst rural businesses whose success relies on farming families. The money farmers receive through the existing CAP system goes a long way to provide public goods that are not supported through the market place, such as landscaped, access, prevention of wildfires and wildlife habitat.

DIVERSIFICATION TO BENEFIT THE COMMUNITY

NSA Next Generation Ambassador Jennifer Craig from Biggar, Lanarkshire, and her father were approached to be in a windfarm project covering farm and forestry ground in their area. With 700ha of mainly hill ground and limited diversification options, Jennifer and her father decided to sign up, and have seen benefits to their business and the community since. They are now provided with a secondary income from the company who lease the land and access roads, whose construction and operations employees spend their money back into the local economy through local shops and accommodation. The project also encompasses a community fund, topped up yearly, through which organisations can apply for funding towards different local projects.



With some farmers turning to tourism, energy production and other diversifications opportunities to stabilise incomes, it is important they given the widest range of opportunities and support. This includes proportionate easing of planning controls, particularly in National Parks, as well as improved broadband and mobile phone coverage. Digital exclusion is highest in rural and hard-to-reach areas where geographical features limit internet access. This means 1.2m small businesses lack the tools required for survival, as a reliable internet connection is often crucial to the success of a business, aiding communication and expanding the target audience (Airband 2015).

NSA believes upland and hill areas would benefit from:-

- **Maintenance and investment into local infrastructure that supports hill farming families and others, such as schools, banks, roads and medical facilities.**
- **Recognition of the historical value, culture and heritage that upland communities provide, and the strong sense of belonging farmers place on their ancestral links to their farm or local area.**

Culture and heritage can be typified by the physical features found in rural areas, and the traditional customs and practices that survive to this day. Both are equally important in understanding the unique source of identity and learning in an area (Natural England, 2013a). Stone walls and barns spring to mind when thinking of physical features, and these are maintained because they still have a role in containing stock, as well as being a link to past agricultural systems. They are important to local history and are of interest to the local community and tourists alike. Environmental stewardship encourages the preservation of cultural and heritage features too, such as protection of historical and archaeological features (including ridge and furrow and sheep washes) and the restoration of historic buildings (Natural England, 2013b). Farmers have a key responsibility as stewards and land managers. This is supported by the Convention on Biological Diversity, which states the importance of 'recognising the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components' (United Nations, 1992).

As well as physical landscape features, cultural heritage also covers traditional practices, customs and dialect. There are many different place names which give reference to sheep highlighting their historical importance, such as London's Shepherds Bush, Sheepstor on Dartmoor, Sheeptown in County Down, many Sheepwalk Lanes, and names of pubs, such as the Ewe and Lamb or the Golden Fleece. A traditional sheep counting system, derived from the Brythonic Celtic language, was used by shepherds up until around 1910, although some of it is still in use. Yan, tan, tethera was traditionally used by shepherds in the North of England, but variations also exist in Wiltshire and Wales (Wikipedia, 2015).

The farming family is widely viewed as the social institution upholding the traditional upland farming way of life. Farmers with ancestral links to the local area have a strong sense of place and link production to their social status within the farming community, demonstrating their desire to make a living from productive farming (Thompson, 2009). There was a time when most of the village got involved in the removing of sheep from the hill, with many villagers having their own sheepdog for this purpose. The social fabric of activities such as this are all but lost. Local and agricultural shows allow for the display of traditional skills and practices, as well as the native breeds of livestock that add distinctiveness to cultural heritage (CPRE, 2012). Shows provide educational tools for the public and preservation of traditional methods to the local community, such as the 18th century practice of showing pedigree animals (ASAO, 2015). Many shows survived the 2001 foot-and-mouth outbreak and are continuing to grow in numbers (ASAO, 2015). The Association of Show and Agricultural Organisations lists 188 shows in its 2016 Members' Handbook. Most of these give an average attendance figure, ranging from 800 to 237,694 (ASAO, 2016) although the attendance figure for the 2015 Royal Welsh Show reached 242,726 people (Royal Welsh Agricultural Society, 2016). ASAO (2015) says six million people, 10% of the population, are now visiting agricultural shows every year. ASAO (2015) describes the important purpose of agricultural shows in the promotion of British farming and education to bridge the gap between the rural and urban divide. Agricultural shows are the perfect opportunity to showcase the inextricably linked rural environment and food production, and can change the public perception of farmers and farming. They allow the non-farming public to 'get on the other side of the farmer's hedge' (ASAO, 2015) through a lively and informative programme of workshops, demonstrations and hands-on activities. With the appropriate marketing, level of creativity and relevant educational themes, it is no wonder they are becoming increasingly popular with the wider public. For farmers, shows provide a business event and social occasion, allowing them to buy and sell, showcase their best work and compare notes with colleagues and trade stands. They can be a vital shop window (ASAO, 2015) for farmers in the latest technologies, trends, methods and machinery from industry leaders, and an opportunity to learn about recent legislation and advice on current topics (ASAO, 2015).

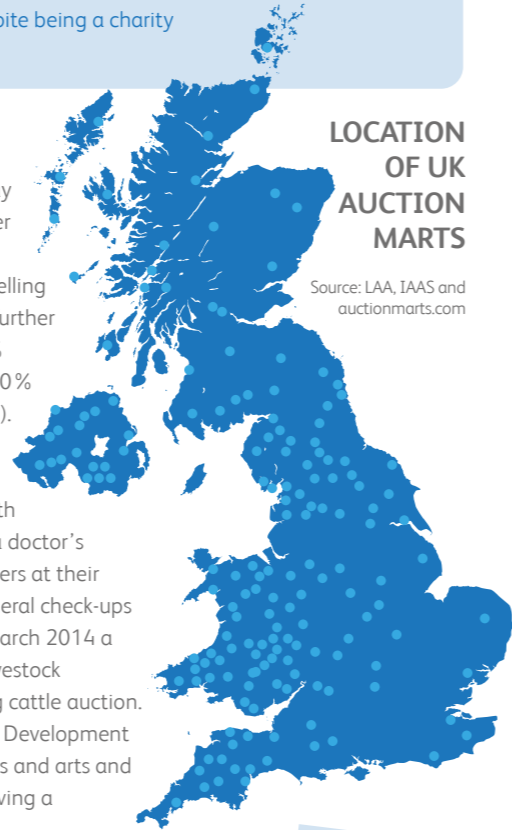


YFC LEGACY IN RURAL AREAS

The first young farmers club was founded in Devon in 1921, and the National Federation of Young Farmers' Clubs was formed in 1932. Now with nearly 25,000 members in 612 clubs, it is one of the largest rural youth organisations in the UK. Covering England and Wales, with similar associations in Scotland and Northern Ireland, members are aged 10-26. NFYFC puts great emphasis on the fact members do not have to be farmers or have any knowledge of farming, just a love and appreciation of the countryside and a 'sense of adventure'. Sarah Palmer, NFYFC Agriculture and Rural Issues (AGRI) Steering Group Officer, says: "NFYFC aims to be the voice of the UK's rural youth and the next generation of farmers. The federation was established for the purpose of advancing the education of its members and their knowledge of agriculture, rural issues and country life. It also aims to promote agriculture as an attractive and viable career choice. The AGRI steering group works to provide information to YFC members, promote the YFC profile for future support and funding, and give YFC members a national voice on industry-related matters." Sarah says being a member of NFYFC opens up a world of events, competitions, skills, experiences and, most importantly, lifelong friends. It also gives its members the opportunity to travel through its YFC travel programme, promoting work scholarships and homestays. NFYFC runs relevant campaigns on topics such as farm safety, road safety, rural mental health and community projects. Despite being a charity themselves, Young Farmers Clubs also raise huge amounts of money for charity.

CASE STUDY

There is an important social calendar surrounding traditional farming activities, such as shearing, livestock shows, hunts and markets, linking sheep farming with a strong sense of community (SAC, 2008). Auction marts are an important social function to farmers who may otherwise be socially and geographically isolated, with 92% of farmers socialising with other farmers in this way (Thompson, 2009). The uplands has a disproportionate amount of livestock markets in comparison to the lowland areas, highlighting the stratified system of selling ewes from the hills to breed prime lambs for slaughter in the lowlands, and store lambs for further finishing. From 2014 to 2015 the Livestock Auctioneers Association saw an increase of 10% on store sheep numbers sold through livestock markets in England (Dodds, 2016). Around 60% of fat lambs and 80% of cull ewes are sold through livestock auction markets (Dodds, 2016). Livestock auction markets can often be a vital link for farmers to other amenities, such as drop-in medical centres. Markets such as Bakewell (Bagshaws, 2016), Louth, Newark and Spalding marts (LRSN, not dated) now hold drop-in medical centres, advice points and health screening services for farmers, who might not otherwise have the time to book and attend a doctor's appointment. The Lincolnshire Rural Support Network runs a helpline and will also visit farmers at their home or business, and give support for mental health and smoking cessation, as well as general check-ups on blood pressure, wound care, ears and eyes (LRSN, not dated). Between April 2013 and March 2014 a total of 1,407 individual check-ups were conducted between Louth, Newark and Spalding livestock markets (LRSN, not dated). Skipton Market also houses the world's only theatre in a working cattle auction. The Mart Theatre opened in 2005, thanks to several funds including the European Regional Development Programme. It hosts a busy and diverse programme of theatre, comedy, music, family shows and arts and crafts exhibitions (The Mart Theatre, not dated) linking farming to the wider public and proving a vibrant social opportunity.



THE ROLE OF RURAL SCHOOLS

Due to changes to funding and falling roll numbers, Forest of Teesdale Primary School in County Durham is facing closure. As essential part of a small rural community for more than 300 years, NSA member Greg Dalton describes the school as having immeasurable importance to the local community, of which hill farming is the predominant occupation. He says: "The school currently only has 14 children on its roll (having ranged from 10 to 25 over the past 10 years) but it is attracting young families to the tenanted farms in the area. Despite its remote location, the school endeavours to provide pupils with the best possible education, life skills and an understanding of life outside the Dale, to prepare them on their journey to secondary school and beyond. It utilises the beautiful environment on its doorstep for learning and upholding the traditions and farming values of the area. With no actual village surrounding the school, it is also a valued meeting place for social groups, the parish council, fundraising events and coffee mornings for the whole community. The school really is the heart of the community here, and represents a traditional way of life which is slowly diminishing in other areas."



CASE STUDY

Many grazing practices and management activities in hill and upland areas are a product of family or local traditions (Chesterton, 2009a) and communities working together, examples being hefting and gathering of stock. Commons have traditionally provided a strong community of farmers working together (Thompson, 2009). While the traditional way of life is still strongly maintained in upland communities, new forms of social interaction are emerging. Whether in response to new or previously unmet needs, or the changing legislation and policy affecting farmers, many new associations, discussion groups and networks are emerging (Thompson, 2009). Farmers and their families are seen as important parts of rural communities, particularly by non-farmers, and are often well represented on school boards and parish councils (Thompson, 2009) and voluntarily help in the community by clearing roads of debris and snow, clearing drains

and rescuing others from floods. Supporting local food supply chains, such as abattoirs, markets and farm shops, boosts the local economy and can increase the profits of farmers by adding value and potentially cutting the additional costs associated with transporting livestock to slaughter (CPRE, 2012). The significant reduction in the transportation of animals also appeals to the consumer as it is perceived as better welfare (CPRE, 2012). The National Federation of Young Farmers Clubs in England and Wales, and its equivalents in Scotland and Northern Ireland, play a huge part in rural society, providing members with social events, skills training and opportunities for travel, as well as raising huge amounts of money for charity. Charity fundraising is important throughout rural communities, including for farming charities such as the Royal Agricultural Benevolent Institution (RABI). The charity operates in England and Wales, with a Scottish equivalent (RSABI) and provides help in a variety of means, from regular or one-off grants, essential household items, disability equipment and relief staff (RABI, 2016a). RABI received 52 referrals between January and May 2016 and provided assistance to 34. Around 28 of these cases were in significant upland areas, 20 from Wales and eight from Cumbria. In 2015 RABI gave out £1.9m in grants to 1,341 individuals and families, with £270,000 going directly to working farmers (RABI, 2016b).

4.3 COMMON LAND & CROFTING

NSA believes upland and hill areas would benefit from support for traditional commons and crofting communities and the goods and services they provide, allowing them to continue as a viable farming practice.

Common land ranges from extensive pastoral grazing, woodland areas, coastal marshes and even land near towns (Federation for Common Land, 2015). It is mostly, but not exclusively, found in upland and hill areas. Beneficial for heritage, public access and environmental factors, commons are protected from development and agricultural intensification through grazing rights and statutory protection (Defra, 2010/2011). Jones (2011) describes Scottish common land as 'socially-significant in the most marginal communities, producing high levels of public goods'. An important part of the landscape, commons provide a range of public goods and services such as space for exercise, recreation and fresh air for the wider public, who often do not understand or appreciate the practice of commoning (Brackenbury & Jones, 2015). There are 1,166,781ha of common land in the UK, 372,941ha of which are in England, 173,366ha in Wales, 591,901ha in Scotland and 28,573ha in Northern Ireland (Foundation for Common Land, 2015). Dartmoor Forest is the largest single piece of registered common land in England and is the source for 45% of all water for Devon and Cornwall. The Long Mynd in Shropshire receives approximately 300,000 visitors a year, including many who visit for its range of outdoor pursuits. West Arkenarthdale Common in the Yorkshire Dales National Park has a significant store of carbon in its peat soils (Aglionby & Morris, 2015).

As with other upland and hill areas, commons have been influenced by fluctuations in policy over a period of years, often made with a lack of understanding about the practice and how it works. Pillar One funded schemes have focussed on high stocking and production, whereas Pillar Two funded schemes have focussed on reductions on grazing pressure for the benefit of the environment (Brackenbury & Jones, 2015). Despite very often causing a reduced stocking rate, the income from agri-environment schemes such as HLS is far greater than the income would be from having more sheep on the common, due to the low returns from sheep farming (Aglionby & Morris, 2015). Many Welsh Grazing Associations use agri-environment schemes within Glastir to manage the pattern and number of animals grazing and financially support the management of the common, but find these schemes to be inflexible to proven methods of grazing control and unable to deal with a range of grazing issues (Brackenbury & Jones, 2015). Farmers are generally in favour of involvement in agri-environment schemes, however they seek flexible schemes that can be site specific and adaptable depending on changing conditions. For commons, this means allowing farmers and graziers to design their own grazing prescriptions for the benefit of the common and to best mitigate any costs occurred, such as fencing, off-wintering and reduced labour (Aglionby & Morris, 2015). This must be taken into consideration as the UK looks towards its future outside the EU and develops its own schemes to support marginal areas. One concern that must be addressed is the protection of legal rights when agri-environment schemes or land designations are agreed.

Part One of the Commons Act 2006 requires electronic registers of all common land to be implemented by all grazing authorities. However, this is both difficult and expensive and, as a result, most local authorities have little or no information regarding the current situation of their local commons (Staley, 2016). NSA hosts the Welsh Commons Forum, a meeting of commons users and council to discuss interests and views around the common land they share. The Welsh Commons Forum played an important role of influence when the Commons Act 2006 was at the bill stage, advising of the importance of live, up to date registers as key to proper management, without which the implementation of other parts of the act becomes difficult (Staley, 2016). It is often forgotten that common rights are attached to the land, not the current owner of the land, and as a result, land has been sold over the years with no obligation to inform the registration authorities of the transfer of rights, and has even been sold for housing developments (Staley, 2016). Some grazings have no committee to regulate them, and the Crofters Commission in Scotland estimates around 20% of crofters' common grazings are completely unregulated, with another 34% technically unregulated (Jones, 2011).

The future of the commons is a concern for many. As with other sectors of upland farming, there is a reducing pool of knowledge and skills as farmers' cease farming and young people move out of the industry in search of better wages. Successful farming of the commons requires knowledge of the specific environment and how it is best utilised by livestock. No two commons are the same, so the knowledge and particular farming practices of each common varies (Edwards, 2006). There is a long history and tradition of farmers on the commons working together and being mutually dependent on each other's stock management practices (Thompson, 2009). There are barriers

preventing new entrants from successfully becoming commoners, which should be addressed through learning opportunities with current graziers. The majority of current graziers in Welsh Grazing Associations are aged between 50 and 70 and only 55% of succession will occur via a family member (Brackenbury & Jones, 2015). Creating schemes where training can be passed from graziers to new entrants could provide a 'match-making' scheme for those without a successor.

UNDERSTANDING THE ROLE OF COMMONS

Jeff Gwillim farms in Talgarth, Brecon, and grazes his sheep on common land. He says the common has seen the effects of both overgrazing and under-grazing over recent times. He says: "In the past we experienced overgrazing on the common, due to the headage payment scheme. This meant many plant species did not have the chance to grow. Now we are seeing the opposite effect, as minimum sheep are now required to claim payments for the land. This means we are seeing bracken encroachment on land previously suitable for grazing, highlighting the need for appropriate stocking levels to keep everything growing as it should and best manage the land." Mr Gwillim also highlights the cultural significance of farmers working together in the unique practice of commoning. He says: "Our hill is so big that, if we don't work together, we can't gather the sheep for important health and welfare interventions. We also work together to help tackle diseases like sheep scab effectively. With less people turning out sheep onto the hill, the remaining shepherds have difficulty in managing their sheep over such a large area. The sheep spread so far over the hill it is leading to under-grazing on the less palatable areas of the hill, as sheep can be more selective".



Crofting is a traditional practice found in the Scottish Highlands and Islands where a tenant crofter is responsible for ensuring his area of land remains productive. Crofts form around 25% of the land in the Highlands and Islands, and therefore about 15% of the land in the UK (Scottish Crofting Federation, not dated). Crofters generally live on the croft or within 32km as specified by the Crofters Commission, either as a tenant or an owner-occupier (Inksters, 2012). There are around 18,000 crofts in total, supporting 10,000-12,000 crofting households and around 33,000 individuals (Crofting Commission, not dated). In Scottish parishes dominated by crofting land use, up to 80% of the farmed land can be common land (Jones, 2011). The Soil Association has set up a scheme to encourage young people into crofting, in order to keep the traditional practice alive for generations to come. Crofting Connections encourages young people from isolated rural communities in the Highlands and Islands to learn about past crofting practices and how they can live an environmentally friendly yet economically and socially viable way of life in the future. Crofting already has a strong cultural identity in these areas and projects like this encourage young people to learn traditional skills and safe-guard their culture and history, while learning the importance of health and environment (Soil Association, 2015). Most crofters are now part-time, subsidising their croft from other employment while crofting for a hobby or to maintain tradition. Crofting is potentially very vulnerable to a reduction in direct or agri-environment payments (Jones, 2011) so must not be forgotten in Brexit discussions.



NSA believes upland and hill areas would benefit from identification of skills gaps in the industry and a joint approach to up-skilling the current workforce for optimal production and utilisation of new technologies.

The uplands and hills need specific, specialist sheep management skills in order for stock to be cared for and businesses to operate successfully. If the next generation do not succeed their parents, or new entrants are not given the opportunity to learn directly from the previous generation, the skills, knowledge and culture which they have learned will be lost, locally and for the industry (Natural England, 2009).

There is also an important need for existing farmers in the sheep industry to be up-skilled and take on new technologies vital for improvement. There is no shortage of knowledge exchange provision in the industry, but there are arguably improvements that could be made in targeting and engaging producers with this information, and achieving efficiencies through avoidance of duplication and use of existing information. For example, the realised returns of genetic improvement technology in the UK sheep industry are substantially below their potential, despite the fact they currently bring an annual £10.7 million benefit to the farmers making use of it (Amer et al., 2015). The widespread impacts of genetic progress are only currently being realised in small areas of the industry, and a step change in the attitudes and skills of the industry towards genetic improvement technology would aid the realisation of its value.

DEVELOPING SKILLS ON DARTMOOR

The Dartmoor Hill Farm Project, set up in 2003, aims to ensure a viable future for Dartmoor farmers, supporting them to establish and run projects to add value to their businesses. The project is funded by the Dartmoor National Park Authority (DNPA), the Duchy of Cornwall and, more recently, the Princes Countryside Fund. It encompasses a database of 388 farms within the national park boundary and most courses are organised within Dartmoor to be convenient for its farmers. Helen and Roy Radmore have benefitted from the work of the project, as Helen explains. "It has helped the whole family attain new skills and get formal training," she says. "It is wonderful. The entire organisation is done for you and usually fits in with the farming calendar. The project is valued by the family and stays relevant to the needs of upland farming and our community." Topics for training courses are suggested by the farmers so they are as relevant as possible, and training is aimed at all family members to recognise the different roles they play in sustaining family businesses. Projects have included social media, business planning, animal health studies, farmer-led training of government agency workers and study trips to Switzerland. The project also encompasses several different groups, aimed at the different interests, skills and generations of the common community. Dartmoor Women in Farming is a social network of monthly meetings over the autumn and winter, with talks and visits covering diversifying into tourism, catering skills and succession planning. There is also a Next Generation group, encouraging under 26s to learn from each other and professionals. Helen says: "Our family hosted a farmer-led training session for Government agencies, which gave both parties an insight into policy making. And my son has enjoyed several meetings and brought new ideas back to the farm. The Forest of Dartmoor Fire Plan has provided training and equipment for 29 commoners to respond quickly to wild fires, the control of which is a formal part of the formal HLS agreement on the common. Helen adds: "The fire training has given commoners the confidence to manage the common better, reduced the risk of wild fire and has given us a plan of action if there is a problem."



There are numerous existing knowledge exchange schemes, including those provided by UK levy bodies. Alongside work to promote red meat and create profitable demands for products, the livestock levy bodies use the statutory levy paid on all beef and sheep slaughtered to share information, support training and conduct research and development, all for the improvement of efficiency, sustainability and cost-effectiveness of the different sectors. In England, the Agriculture and Horticulture Development Board (AHDB) for Beef and Lamb received £15.773m in 2014/15 (AHDB, 2015b). This was supplemented by other fee, grant and commercial incomes and 20% of the total income to AHDB Beef & Lamb (formerly EBLEX) was spent on research and development and knowledge transfer (AHDB, 2015b). For Hybu Cig Cymru (Meat Promotion Wales), the same organisation for Welsh levy payers, the sheep levy was the greatest contribution to the total in 2014/15, at 66.33%. The split in levy spend for 2014/15 saw 10.57% go towards industry development (HCC, not dated, b). The equivalent body in Scotland is Quality Meat Scotland (QMS), which also covers 90% of farmed livestock in its internationally recognised assurance schemes (QMS, 2016). Its 2014/15 income from the statutory red meat levy was £4,095,837, with 16.9% spent on industry development. The situation is slightly different in Northern Ireland, where most of the levy goes to the Livestock and Meat Commission (LMCNI) but Agrisearch, part of the Northern Ireland Agricultural Research and Development Council, uses some levy to fund many of the projects undertaken by the Agri-Food and Biosciences Institute (AFBI). In 2015, the sheep total sheep levy was £24,963, but there was additional sheep income contribution from LMCNI of £19,956 in 2015. In 2014, this contribution was much greater at £35,000, due to a one-off special project. The expenditure on direct programmes in 2015 including research and development, was £428,948, which was 95% of the total income from total levy payments alone (Agrisearch, 2015).

Other programmes are funded by the Government. For example, skills and training provided under the Rural Development Programme for England are 70% funded, Defra-managed and include 32 training providers (Gov.uk, 2014). The available courses range from management, business skills and ICT to traditional rural skills (Gov.uk, 2014). Some of the main providers include UKRS (UK Rural Skills), who aim to enrich rural communities by raising standards, increasing safety and boosting efficiency and productivity (UKRS, 2016). Innovation for Agriculture is a consortium of 15 English agricultural societies delivering new science and innovation to farmers from its technical centres around England. Communicating through websites, publications, conferences, workshops and on-farm demonstrations, Innovation for Agriculture focusses on precision livestock and animal health and welfare, soil and water, renewable energy and the uplands (Innovation for Agriculture, 2016). The

Agri-Skills Forum (2016) was set up in 2008 to ensure that skills in the agricultural and horticultural industries were being sufficiently addressed. The forum works alongside industry stakeholders, Lantra (land-based and environmental skills) and Landex (land-based colleges aspiring to excellence) and aims to achieve a UK-wide profitable and sustainable industry that can meet the demands of 21st century land management and is a valued part of society. In the 2013 report 'A UK Strategy for Agricultural Technologies' (HM Government, 2013), it was stated that the Government aimed to build on the work done by the Agri-Skills Forum, with a vision for the UK to become a world leader in agricultural technology, innovation and sustainability. It recognises that the UK agricultural sector already has a strong set of skilled workers, world class retailers and is a traditional leader in agricultural sciences, but the current regulatory regime and skills gap is hindering the development and use of new technologies and innovation. The Government pledged to spend £90 million over the five years from 2013 to establish Centres for Agricultural Innovation, focussed on helping businesses develop through technology and skills, and providing a platform for training, skills development and succession planning. By making the skills and training more demand-led, it would bring closer links and greater access to the many successful agricultural colleges, higher education and research institutes, updating the skills of those currently in the sector and attracting new entrants. While it can be assumed this funding is safe through to 2018, the longer-term future for this type of support is unclear with the UK potentially not having the same funding opportunities outside the EU. The Government has said developing a skilled workforce, alongside use of new technologies and regulation for risk and innovation, is the way for the UK agricultural sector to increase productivity and become a real contributor to food security and international development (HM Government, 2013), and this must not be forgotten in future discussions. Of equal importance is the research that must be conducted to ensure new technologies and skills are always being developed for the agricultural sector to take up and use in order to move forward. European funding has been an important catalyst for some of this research in the past and the UK must not be allowed to fall behind the rest of the world as it designs and determines its future outside of Europe.

A Government review concluded upland farmers need strong business skills and new and entrepreneurial outlooks in order to make the best of their businesses. It said they should seek greater efficiencies by cutting costs and maximising incomes, pooling resources with neighbours and using contractors to help reduce costs of staff and equipment. Greater efficiencies will also aid the reduction of the carbon footprint of their enterprise. Producing higher value products, such as special breeds, or finishing their own stock, can help gain greater profits, and additional benefits can be gained by partnering with businesses such as water companies, where farmers are rewarded for taking measures to improve water quality (Defra, 2010/11).

Succession is an important, yet sensitive and concerning issue for many farmers, and organising a successor should be actively encouraged. The average age of farmers in the UK currently stands at 59, with a third of farmers aged over 65 (Defra et al, 2015). The idea of creating a 'genetic link' between farmers of the past, present and future is popular with farmers when thinking about their successor, with the transfer of knowledge and traditional skills to their children who they see as already possessing a farming temperament and having farming 'bred into' them (Thompson, 2009). This could be seen as discriminatory towards those who are passionate and could bring new ideas to the industry, but lack the ancestry link to farming, preventing the Government from realistically getting involved in promoting succession with the aim of creating a genetic link (Thompson, 2009). However there is evidence to suggest that some farmers encourage their children to stay in education and pursue other careers (Thompson, 2009), perhaps as they do not see farming as financially viable for the future.



NSA believes upland and hill areas would benefit from:-

- Support and encouragement of future generations entering upland livestock farming with a holistic focus on productivity and provision of public goods.
- Support for existing and older farmers to step back with dignity.

It is estimated that for a sustainable future agriculture must attract 60,000 new entrants over the next decade (Glover & Cazalet-Smith, 2013). Sheep farming can often be the first step towards a larger, more diverse enterprise as it traditionally carries lower capital and investment costs and less need for a permanent base. The report 'A vision for British lamb production' by the NFU and NSA (2014) highlights the successes and opportunities in the sheep industry by attracting and maintaining new entrants. Although starting from a low base, it acknowledged an increase in the number of young people attending agricultural events, industry activities and sheep-related courses at agricultural colleges and universities. It is good news for the industry if this means the new blood coming through is knowledgeable and skilled, but these people must continue to be inspired and provided with the tools for best practice. This is where the biggest gains can be made, as young people tend to be more open to the use of new technologies and systems and can develop business skills that enable them to improve the industry and sustain it for the future. In order to compete in a volatile market, they must have an entrepreneurial outlook and seek to add value through greater efficiencies by cutting costs and increasing outputs (Defra, 2010/2011).

ENCOURAGING THE NEXT GENERATION

NSA Next Generation is an initiative that supports the future of the sheep sector by encouraging participation by young people. The overall aim is to provide an informative service for young people looking to enter the industry or improve the family business, through training, competitions and events. Joanne Briggs, who coordinates the NSA Next Generation activity, explains that it includes a yearly intake of up to 12 NSA Next Generation Ambassadors: "These individuals are selected for their passion for the future of the sheep industry and undertake several training sessions and seminars over the course of the scheme, to provide them with the ideas and tools for a prosperous business.

The rigorous selection process ensures an even spread from across the UK, which also helps sustain the future of NSA's vital work at a regional level, encouraging future office holders and volunteers. Themes of the training sessions range from performance recording and grassland management to financial management and media training."

There are various organisations that support young and new entrants to the industry through funding and schemes, including NSA through its Next Generation initiative and Ambassador programme. NSA provides a lambing list where farmers can advertise work experience placements at lambing time, providing valuable opportunities for agricultural and veterinary students. There is also the opportunity for NSA to match-make young people with longer work experience opportunities, university sandwich placements and paid employment. Keen young shepherds under the age of 27 are able to enter NSA Young Shepherd competitions, where they demonstrate their abilities in lamb classification, handling, shearing and ATV use, refining their practical skills and industry knowledge (NSA, not dated). The Prince's Countryside Fund (2013) provides funding for several different projects, including the Hill Farming Succession Scheme. This aims to train five farmers from target valleys of Cumbria to become mentors to young people and educate public and agency staff, and train eight young people over a period of two years in hill farming skills, gaining experience from the farmers and skills to maintain countryside infrastructure. The Farmer Network is a non-profit organisation operating in Cumbria and the Yorkshire Dales, to support, help and guide its members and improve the sustainability of their farms. It aims to encourage local farmers to work together, improve efficiency, increase knowledge and skills, increase revenue and educate the public (The Prince's Countryside Fund, 2013). In 2014, the Farmer Network gave £20,000 worth of technical training grants to 104 of its members, and provided five young people with £6,000 in grants and £77,000 in low interest loans to help them develop their businesses. It also provides a labour directory for farmers looking for labour or contractors looking for work, with some even offering free help (The Farmer Network, 2015). Also funded by The Prince's Countryside Fund are the academies run by the Fresh Start Land Enterprise Centre (FSLEC). These are open to anyone aged over 18, from a farming or non-farming background, looking to start a new business or diversify and existing one, and providing mentoring

CASE STUDY



support and workshops. The scheme also provides a matchmaking service for those looking for a joint venture or business opportunities (FSLEC, 2014). Venture is a Welsh Government initiative containing a database of new entrants and established farmers looking to wind down, and can connect the two as joint venture partners. The scheme also provides skills, guidance and support, a training package, legal advice and mentoring (Welsh Government, 2016). The Scottish Forestry Commission piloted a scheme in 2012 allowing new entrants to lease part-time started farms on the National Forest Estate in Scotland. The result was two new successful tenancies, and since then eight new tenancies have been rolled out. Not only does this allow successful applicants to gain valuable experience in managing their own small-scale farm business but it also delivers a vital part of the Scottish Minister's climate change programme. There are also starter business units for agricultural grazing opportunities on the estate for new entrants, enhancing environmental objectives through low input / low output methods (Forestry Commission Scotland, 2016b). It is important that all these schemes are encouraged to grow and complement each other, as despite the quality of the existing activity, it is disproportionately small to the volume of new entrants needed to sustain the industry. It is also important to recognise the need for proper succession planning or share farming partnerships for the older generation, which could be a difficult subject for farmers and their families, but is essential for the future of the business whilst meeting the needs of the older generation and maintaining their dignity.

Under the most recent CAP reform all member states are required to have an allowance for a scheme to support new entrants. In England, the Young Farmers' Scheme was assigned 2% of the money set aside for direct payments and this was thought to be able to cover 10,000 applicants (Defra, 2014b), although at the time it was not expected there would be this many. The applicant must be an individual under the age of 40 and have set up their business within the last five years (Defra, 2013). In Wales, a similar scheme provides support in the form of the Young Entrants Support Scheme. This scheme requires entrants under the age of 40 to be head of holding for the first time in the last 12 months and to have adequate skills and competence (Welsh Government, 2015). Similarly, in Northern Ireland, the Young Farmers Scheme for heads of holding under the age of 40 will aim to provide a top up of €84/ha for up to 90ha, providing the applicant has a minimum level two qualification in agriculture (CAFRE, 2016). In Scotland, there is the Young Farmers Start-Up Grant Scheme for those starting an agricultural business for the first time or taking over an existing business, be it a farm or a croft. The five-year plan is aimed at 16-40 year olds who must have a minimum of 3ha, and can be the equivalent of €70,000 in two instalments (Scottish Government, 2016a). The New Entrants Start-Up Grant Scheme running alongside it has no upper age limit but still requires a minimum of 3ha and is aimed at farmers or crofters who started up within 12 months of application to the scheme (Scottish Government, 2016b). The uptake of these four schemes has been variable, depending on how prescriptive it is, but the concept of having this support is essential for the long-term sustainability of the industry and must not be neglected in future discussions for a UK support system outside of the EU.

Allied activities to sheep farming also attract new entrants, such as veterinary, research, trade and supply companies, food science and environmental fields. The industry requires new entrants at all these levels, not just sheep farming. Without an interest of new entrants into these sectors, existing sheep farmers would be forced to go further afield for the services and advice they need, causing additional costs.

5.1 ECONOMIC OUTPUTS:

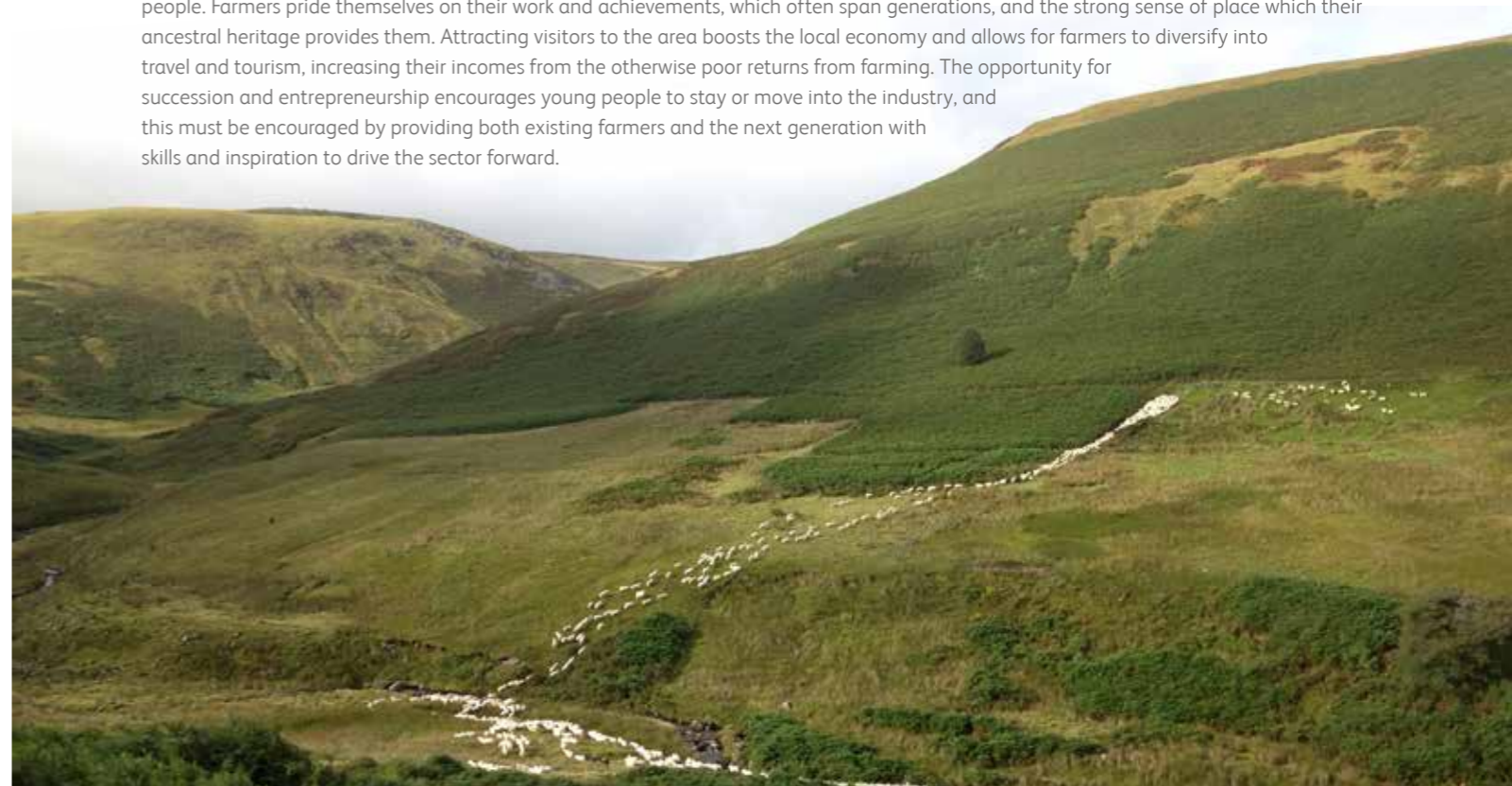
A stable, sustainable sheep industry is essential to supply domestic, export and developing markets with nutritious and enjoyable food for a growing world population that is expanding in ethnic diversity and wealth. Sheep meat will be the primary economic driver for the industry for the foreseeable future, with breeding stock and store lamb production being a key part of this. Decision makers and the public should be better informed on the importance of red meat, in particular sheep meat products, as part of a balanced diet with responsible credentials. The support of large retailers to improve public awareness is of great importance, but also to promote products that support the traditional hill system. Adding value through wool and other sheep related products is crucial and retailers and textile manufacturers could develop the British wool industry to driver better prices for fleeces. The traditional stratified sheep industry, unique to Britain, is an economical, practical and environmentally sensible way of sheep farming, making the most of the different characteristics of breeds and environments. However, the stratified sector must rise to the challenges presented, particularly in relation to disease control and information sharing. The loss of breed traits of hill pure breeds and upland Mules would change the entire face of the sheep industry and it is highly desirable to create and maintain a wide range bank of genetic material. It is vital the hill and upland sheep sector, producing sustainable meat and wool, is additionally supported and financially rewarded for the public goods and services it provides.

5.2 ENVIRONMENTAL LINKS AND OUTPUTS:

The unique environment created by hundreds of years of upland farming provides a valuable source of quality water, carbon sequestration and biodiversity. The uplands provide an environment of minimal input use and pollution, giving clean, fresh water much further downstream and combating carbon dioxide emissions by transforming the gases into valuable stores of carbon. Rough vegetation and areas of woodland are excellent forms of flood mitigation and create habitats for the many species that share the environment with grazing livestock. Farmers are important managers of their environment and must be encouraged to maintain the mosaic habitats of heather and shrubs, by the removal of bracken through grazing and other forms of management. Appropriate stocking rates are essential to environmental outputs and schemes must be flexible and site-specific in order to avoid the detrimental effects of both over and under-grazing. It is important the traditional practices and environmental management undertaken by farmers are not undermined by a desire of other interest groups to rewild the landscape, reducing our farming capital and making the countryside inhabitable to more fragile plant and animal species, and less accessible to visitors.

5.3 SOCIETAL LINKS AND OUTCOMES:

Upland communities, of which farmers are a central part, provide a wealth of social and health benefits for residents and tourists alike. Many people working in urban areas look to the great outdoors for recreational activities and to boost their mental and physical health, with proven results. They also provide a wealth of history and culture, with many traditional practices, buildings and ways of life maintained by the local people. Farmers pride themselves on their work and achievements, which often span generations, and the strong sense of place which their ancestral heritage provides them. Attracting visitors to the area boosts the local economy and allows for farmers to diversify into travel and tourism, increasing their incomes from the otherwise poor returns from farming. The opportunity for succession and entrepreneurship encourages young people to stay or move into the industry, and this must be encouraged by providing both existing farmers and the next generation with skills and inspiration to drive the sector forward.



NSA believes upland and hill areas would benefit from the following changes.

FOR ECONOMIC OUTPUT

- Improved resources for marketing of upland lamb and other sheep products.
- Mitigation against market volatility.
- Promotion of the health benefits of predominantly grass-fed red meat to a wider audience.
- Sustainable prices for producers and consumers.
- Recognition of the value of upland and marginal sheep genetics to the UK gene pool and its wider sheep systems.
- The development of practical health assurance schemes and increased sharing of information by sellers to give confidence to buyers of breeding stock and store lambs.
- Encouragement of retailers and consumers to consider the unique benefits of British wool in an attempt to get better and fairer prices for sheep farmers.
- Encouragement of retailers to embrace heritage breeds as new and diverse products, resulting in more mainstream interests in these niche markets.
- A farm support and reward system, developed post-Brexit, which caters for all agricultural sectors but specifically increases the financial recognition of provision of a broad range of public goods.
- Payment (via public and private means) for eco-system services based on reward and deliverables, and not income foregone.

FOR ENVIRONMENTAL LINKS AND OUTPUT

- Deeper understanding of the role sheep and the uplands play in prevention and mitigation of flooding and the supply of vital clean water to many urban communities.
- Recognition of the extreme importance of the uplands as carbon sinks, in particular peat soils, and the role that farmers play in protecting them.
- Recognition of the environmental and societal benefits of grazing and farming to reducing risks of wildfires.
- Encouragement of farmers to control bracken responsibly.
- Recognition of the value of sheep grazing to ecology and biodiversity.
- Site-specific grazing prescriptions and exploration of outcomes approaches, as there is no such thing as an optimal grazing level for all habitats and different seasons/weather require flexibility.
- Trees and valuable areas of scrub within grazing areas no longer being classed as permanent ineligible features (PIF) under the Basic Payment Scheme or its post-Brexit successor.
- Resolution of contradictions between the Basic Payment Scheme and agri-environment schemes, and steps taken to ensure no such contradictions exist in post-Brexit schemes.
- Easing of licences for control of problematic protected species, such as badgers, ravens and sea eagles, to a level that keeps farming and wildlife in balance.
- Recognition that the UK has very little truly wild landscape, instead the landscape, wildlife and ecology seen today is a result of thousands of years of farming.

FOR SOCIETAL LINKS AND OUTCOMES

- Proportionate easing of planning regulations, particularly in National Parks, to encourage and allow investment and appropriate energy-generation projects.
- Improved broadband access and mobile phone coverage, to allow resource access and facilitate diversification.
- Recognition of the multiplier effect and how farm enterprises support many other local business and services.



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