



Grouse shooting and management in the United Kingdom: its value and role in the provision of ecosystem services

1. EXECUTIVE SUMMARY

Recommendations

- **Recognition by policymakers and stakeholders** of the important positive contribution of grouse shooting to a sustainable future of conservation and ecosystem service provision for the uplands.
- **Appropriate support** to assist the creation and / or improvement of shooting enterprises in the uplands, and facilitate the route of grouse meat to market. Support and funding, for example via Local Enterprise Partnerships (LEP) or Payment for Ecosystem Services (PES) schemes, would i. help retain and maximise socio-economic benefits and market opportunities provided by grouse shooting such as economic activity, jobs and game meat production, and ii. support the provision of cultural, health and wellbeing benefits.
- **All stakeholders to come together**, engage in constructive dialogue, agree common ground and develop workable, pragmatic and evidence-based solutions to management challenges.
- **A joined-up approach** from the private and public sectors. A constructive dialogue between the grouse shooting industry, key governmental and non-governmental agencies, and local communities in grouse shooting areas, will help realise the potential of, and help mitigate any conflict surrounding, grouse shooting in the uplands.
- **Policymakers to work with the grouse shooting community** to produce supportive evidence-based uplands policy which follows the five principles of better regulation, considers socio-economic aspects and avoids unintended consequences.
- **All moorland managers to follow current best practice.**

The role and value of grouse shooting and management

- The economic inputs, environmental labour and investment, and social aspects of grouse shooting in the uplands have an important positive role in sustainably maintaining and improving the provision of supporting, regulating, cultural and provisioning uplands ecosystem services.
- Grouse moor management is integral to a sustainable future of ecosystem service provision in the uplands.
- Grouse moor managers have a crucial role as custodians of upland areas, and are private investors of time and money into upland areas. This has many benefits, including socio-economic support for upland communities, decreasing the likelihood of rural depopulation and helping the UK reach and maintain its conservation objectives.
- Limiting or reducing grouse shooting activity would result in a variety of socio-economic and environmental unintended consequences, which may ultimately damage the health of upland communities and conservation and slow peatland restoration potential.

This paper is organised as follows:

- **Section 2** introduces grouse shooting and management.
- **Section 3** considers the various roles of, and general services and benefits supported and provided by, management for grouse shooting.
- **Section 4** discusses these, explores various aspects of grouse moor management in more detail, and looks to the future.
- **Section 5** contains recommendations for the continuation and maximisation of the benefits outlined in Section 3, whilst taking into account of points raised in Section 4.

2. WHAT DOES GROUSE SHOOTING AND MANAGEMENT FOR GROUSE INVOLVE?

Grouse shooting has taken place in the UK for more than 160 years (Tharme *et al.* 2001). The red grouse (*Lagopus lagopus scoticus*) is generally considered to be a subspecies of the willow grouse (*Lagopus lagopus*). Red grouse is unique to the British Isles where it lives in wild populations (British Trust for Ornithology (BTO) *n.d.*¹). In 2009 it was estimated that 230,000 pairs were present in the UK (BTO *n.d.*; Musgrove *et al.* 2013). Heather (*Calluna vulgaris*) is its primary source of food throughout the year (Moss & Parkinson 1972), hence red grouse are sedentary to areas of heather moorland within the British Isles (Mullarney *et al.* 1999). They prefer young, fresh shoots to eat and older heather for cover. Young grouse feed on insects for the first few weeks of their lives, before progressing to the same diet as adults (RSPB *n.d.*).

Generally, driven grouse shooting takes place when post-breeding grouse populations exceed densities of 60/km² (Hudson 1992), where the birds are driven by people ('beaters'), over shooters who stand in shooting hides. Walked up grouse shooting also takes place, usually when birds are found at a lower density. Here birds are flushed out of cover by dogs or walking shooters. A variant of walked up shooting is 'grouse over pointers', where the birds are flushed by dogs. Shot grouse are customarily retrieved by teams of gundogs and their handlers ('pickers up'). Whether driven or walked up, grouse shooting is characterised by a strict code of conduct which ensures that best practice, respect for quarry and safety considerations are paramount.

Driven grouse shooting typically results in a higher harvest of grouse, involves more shooters per day, produces a higher revenue per brace, and requires more employment than walked up grouse shooting (The Moorland Association *n.d.*; Sotherton *et al.* 2009). If a commercial grouse shooting estate switched to offering only walked up shooting without driven grouse shooting, the loss of demand and lower income generated would result in reduced employment of keepers, decreasing the amount of time and effort which could be put into predator control and land management (The Moorland Association *n.d.*; see also Warren & Baines 2014). See **Section 3.3.2** for more information on employment.

¹ The initials '*n.d.*' represent references which are undated, i.e. for which the date of publication is not specified

2.1. Location

Grouse shooting takes place in upland areas. Although there is no agreed definition for the term ‘upland’, these areas are generally taken to mean areas of mountain, moor and heath; high ground above the upper limits of enclosed farmland, largely covered by dry and wet dwarf shrub heath species, blanket bog and rough grassland (Natural England 2012). Uplands contain peat soils of varying depths. Scotland is home to most grouse moors, having vast expanses of heather moorland – but in England, grouse shooting takes place on moorland as far south as the Dark Peak in Derbyshire. Grouse moors may vary in size from 200 - 10,000 hectares (BASC *n.d.*; The Moorland Association, *pers. comm.*²). Research conducted by the Game and Wildlife Conservation Trust (GWCT) estimated that grouse shooting estates in England were smaller than those in Scotland by an average of 300 hectares (GWCT 2004).

The total upland heath area in the UK has been assessed as between 2 and 3 million hectares (JNCC 2008^a). Scottish Land & Estates estimate that 1 million hectares is used for grouse shooting in Scotland (Scottish Land and Estates & Scottish Moorland Group 2013). The Moorland Association estimates that its members (England and Wales) are responsible for managing around 343,983 hectares of heather moorland, which represents around 89% of the heather moorland remaining in England and Wales (The Moorland Association *n.d.*^a). At least 1.3 million hectares of upland Britain are therefore influenced by management for grouse shooting. This estimate fits with that of Grant *et al.* (2012), who proposed the total area of grouse moor in the UK was between 0.66 and 1.7 million hectares.

Figure 1: Red grouse breeding distribution in the UK 2008-11. From Balmer *et al.* (2013), reproduced with kind permission from BTO

Breeding Distribution 2008-2011

- Non-breeding
- Possible
- Probable
- Confirmed

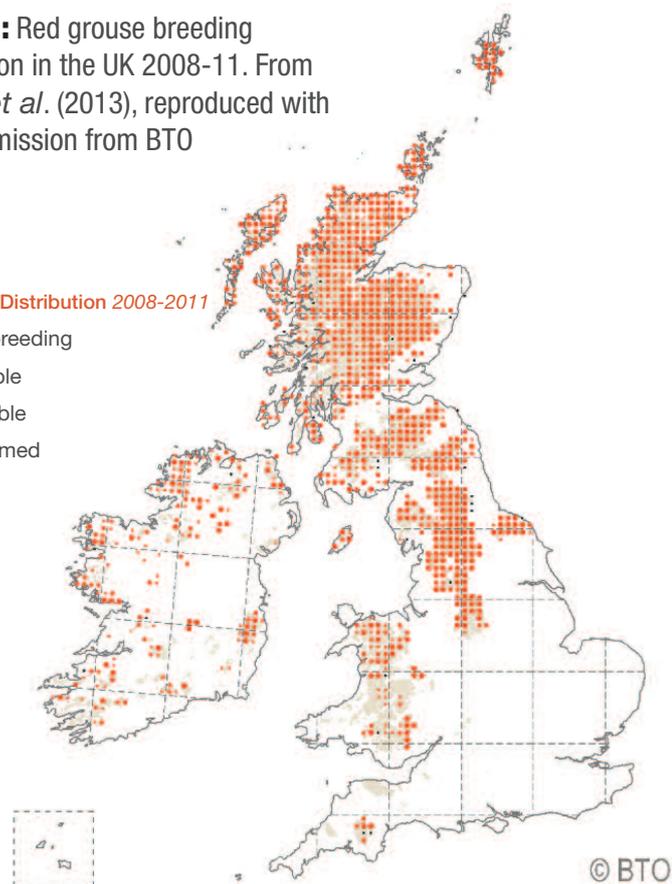
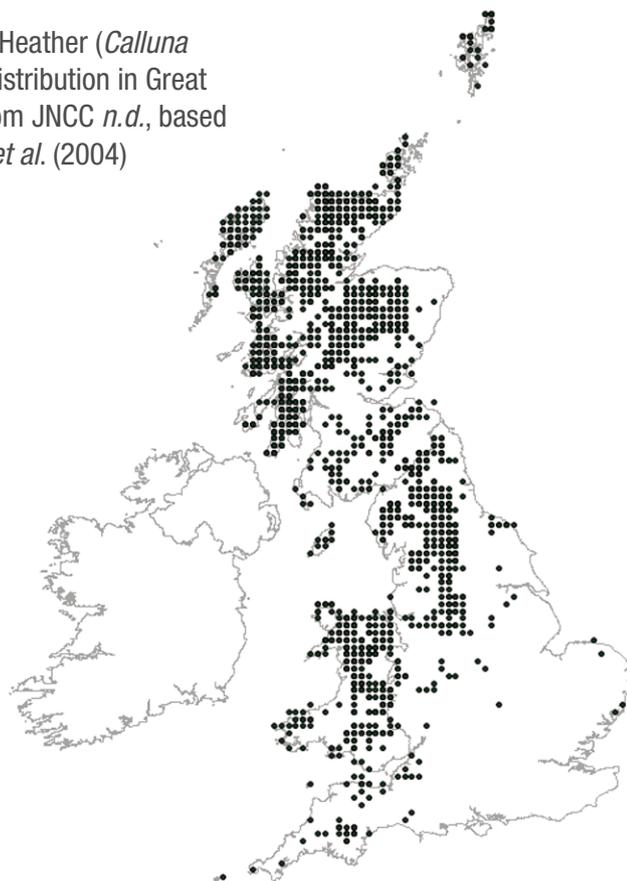


Figure 2: Heather (*Calluna vulgaris*) distribution in Great Britain. From JNCC *n.d.*, based on Averis *et al.* (2004)



² The abbreviation ‘*pers. comm.*’ represents a personal communication from the stated person or organisation



2.2. Management overview

In their manual of red grouse and moorland management, Hudson & Newborn (1995) describe the objective of grouse moor management as ‘to provide a sustainable harvest of grouse from a specific area of heather moorland within a balanced package of multi-purpose land use’ – with those multi-purpose land uses including sheep grazing, deer stalking, conservation and public enjoyment of the upland environment.

For driven grouse shooting, an approximate ‘optimal keeping’ level is one gamekeeper per 2,500-3,000 acres (1012-1214 hectares) of moorland managed for grouse (The Moorland Association *n.d.*^b and *pers. comm.*). Moorland management for grouse requires gamekeepers to keep predator numbers low through seasonal and targeted legal avian (such as corvid) and mammalian (such as fox *Vulpes vulpes*) predator control. Within a year, gamekeepers will undertake a carefully planned programme of work designed to ensure the moorland is in good health to support grouse – including heather burning, cutting heather, monitoring and controlling grazing of heather, addressing the impact of pests such as heather beetle *Lochmaea suturalis*, and controlling disease, ticks and invasive species such as bracken (*Pteridium*). This careful management regime takes place throughout the year on grouse moors, and is crucial to maintaining heather moorland.

The grouse shooting season itself lasts 121 days in England, Scotland and Wales (12 August to 10 December) and 111 days in Northern Ireland (12 August to 30 November). It is estimated that no piece of ground will be shot more frequently than once a week in a season (The Moorland Association, *pers. comm.*). Within the gamekeepers’ annual calendar, the number of days during which shooting takes place makes up a rather small proportion of overall annual effort expended, whereas work on other activities can invariably occur year-round. The benefits of this effort are far-reaching and crucial to maintaining many aspects of upland ecology.

3. WHAT BROAD-SCALE BENEFITS AND SERVICES DOES GROUSE SHOOTING AND MANAGEMENT PROVIDE?

Ecosystem services assessments are an increasingly common way to value services provided by natural environments. There are four types (adapted from Millennium Ecosystem Assessment 2005, Natural England 2009^a; TEEB 2010):

Service type	Description	Example(s)
Cultural	Services providing non-material benefits from ecosystems.	Cognitive development, reflection, recreation, education, aesthetic experiences.
Supporting	Services which are necessary for the production of other services.	Provisioning of habitat, primary production, water cycling, nutrient cycling.
Regulating	Benefits derived from the way ecosystem processes are regulated.	Flood regulation, water purification, air quality maintenance, carbon storage and sequestration, climate regulation, pest and disease control.
Provisioning	Products obtained from ecosystems	Food production, animal products, crops, fresh water.

Uplands provide every type of ecosystem service, and moorland management for grouse shooting has an important role in sustainably maintaining and improving the provision of these services. An inquiry into the future for England's upland communities noted that there were positive synergies between moorland management shooting, environmental goals and ecosystem service provision. Furthermore that 'this is a "free service" on the basis that private investment saves public money by delivering environmental benefits' (Commission for Rural Communities 2010).

3.1. Habitat management and conservation

Cultural

Supporting

Regulating

Provisioning

3.1.1 Conservation designations

Heather moorland encompasses upland heath and blanket bog, both of which are UK priority habitats. Upland heathland encompasses a range of National Vegetation Classification (NVC) plant communities (JNCC 2008^a). Blanket bog vegetation may also contain ‘substantial amounts of dwarf shrubs, but is distinguished from heathland by its occurrence on deep peat’ (JNCC 2008^b). Grouse moor managers have a crucial role as custodians of upland areas at a landscape level, and can help the UK reach and maintain its conservation objectives. Research shows that 79% of the land area of the North Pennine Moors, North York Moors and South Pennine Moors Special Protection Areas (SPAs) are managed for grouse (Aebischer *et al.* 2010). The concentration of moorland breeding waders in the North Pennines appears to be a direct result of grouse moor management – leading to SPA designation (GWCT 2010). Agri-environment schemes on their own, without predator control, seem unable to give rise to an abundance of breeding waders or even bring about a significant improvement in sparse populations (GWCT 2010).

Grant *et al.* (2012) noted: ‘The UK’s moorland habitats are considered to be of high conservation value... Several of the main vegetation communities are either virtually confined to Britain and Ireland, or are better represented here than elsewhere, and 13 of the communities are listed under the EC Directive on the Conservation of Natural Habitats and Wild Flora and Fauna. Upland dwarf-shrub heath, active blanket bog and upland calcareous grassland are also UK BAP habitats. Furthermore, UK moorlands hold important invertebrate and breeding bird assemblages, including a high proportion of bird species of moderate to high conservation priority in the UK, as well as several that are listed on Annex 1 of the EC Birds Directive.’ The interface between open heather moorland and other habitat types (‘moorland fringe’) is also an important habitat for many species. An investigation into moorland fringe biodiversity in the Galloway Forest Park in Scotland recorded 59 bird species in its moorland fringe areas, of which 29 were included on lists of conservation concern, and the majority were associated with moorland fringe habitats (Calladine *et al.* 2014).

A study by the GWCT (2004) demonstrated that estates managed for red grouse had double the labour input of other land uses. The research also used the amount of land designated as Sites of Special Scientific Interest (SSSI) as one measure of environmental quality. On average, the study notes, SSSIs made up 16% of the upland area of Britain, and shooting estates surveyed covered 15%. Results showed that shooting estates accounted for 29% of this upland SSSI area, compared with the expected proportion of 16% had it been randomly distributed (GWCT 2004). See **Section 4.2** for more information on SSSIs. Also see the BASC white paper ‘The role of shooting in landscape scale land management’ for more information on the role that shooting plays in managing the environment.



Bird species in this section are shown in bold and colour-coded according to their conservation status, as defined by Birds of Conservation Concern 3 (2009)³.

3.1.2 Biodiversity value

A range of additional species benefit from the predator control and habitat management carried out for **red grouse**. A rich body of evidence demonstrates that grouse moors are important for many of the UK's threatened waders, such as **golden plover** (*Pluvialis apricaria*), **lapwing** (*Vanellus vanellus*) and **curlew** (*Numenius arquata*). The importance of grouse moor management to these species can be seen clearly where management for grouse is discontinued.

One example is at the Berwyn Special Area for Conservation (SAC), which is the most extensive blanket bog and upland heath in Wales. By the late 1990s driven grouse shooting there had ceased. Between initial surveys in 1983-5 and a further survey in 2002, **lapwing** were lost, **golden plover** declined by 90% and **curlew** by 79%. Changes in distribution were observed in **curlew**, occupying 57% fewer study plots in 2002. Targeted moorland management, including habitat enhancement and the control of generalist predators, was recommended to restore numbers of key species of ground-nesting moorland birds (Warren & Baines 2014).

Furthermore, Baines *et al.* (2008) investigated the effects of reduction in keeping activities on a Scottish grouse moor on breeding birds. **Red grouse**, **golden plover**, **curlew** and **skylark** (*Alauda arvensis*) were two to three times more abundant when moorland was kept for grouse than when it was not, and **lapwing** populations were virtually lost when keeping ceased. Another study by Fletcher *et al.* (2010) investigated the effects of predator control on breeding success and abundance of ground nesting bird species on moorland in northern England. Predator control increased breeding numbers of **lapwing**, **curlew**, **golden plover** and **red grouse**, which declined in the absence of predator control. Predator control led to an average threefold increase in the breeding success of **lapwing**, **curlew**, **golden plover**, **red grouse** and **meadow pipit** (*Anthus pratensis*).

³ www.bto.org/sites/default/files/u12/bocc3.pdf

Research by Aebischer *et al.* (2010) compared wader species' ranges in relation to the status of grouse moor management in four areas of the UK. Although range contractions occurred across all regions, the extent of these was reduced where grouse moor management was widespread, benefiting **red grouse**, **curlew**, **golden plover**, **lapwing** and **dunlin** (*Calidris alpina*). GWCT compared breeding distributions of upland waders and **black grouse** with areas of moorland management, and found positive associations between presence of breeding **black grouse** (*Tetrao tetrix*), **dunlin**, **curlew**, **golden plover**, **lapwing**, **redshank** (*Tringa tetanus*), **snipe** (*Gallinago gallinago*) and percentage of moorland managed for grouse. Management for grouse led to significantly greater chances of breeding waders and **black grouse** being present on the moor (GWCT 2004). In fact, around 95% of **black grouse** leks occur on the fringes of managed grouse moors (Warren *et al.* 2011).

Research by Tharme *et al.* (2001) focused on upland areas of eastern Scotland and northern England, and assessed whether population densities of breeding bird species differed between moorland managed for grouse and other moorland with similar vegetation. They found that densities of breeding **golden plover** and **lapwing** were five times higher on grouse moors than other moors. Furthermore, **red grouse** and **curlew** breeding densities were twice as high on grouse moors than others, although **meadow pipit**, **skylark** and **whinchat** (*Saxicola rubetra*), were less abundant. The researchers noted that the higher densities of **red grouse**, **golden plover**, **curlew** and **lapwing** on grouse moors compared to other moors, suggest grouse moor management may help to maintain populations of these species, all of which had declined in geographical range in Britain. Furthermore, that continuation of grouse shooting might be valuable for biodiversity conservation in the uplands in ways which could not be substituted if alternative land uses took the place of grouse shooting.

A Natural England Evidence review on the effects of managed burning concluded that there was strong evidence burning and predator control intensity correlated with higher densities of **red grouse**, **golden plover**, **curlew**, **lapwing**, **redshank**, and **ring ouzel**. While the review also noted lower densities of **skylark**, **wheatear** (*Oenanthe oenanthe*), **twite** (*Carduelis flavirostris*) and **meadow pipit** had been associated with increased intensity of burning or predator control, in these studies most other species did not show significant correlations with burning or predator control (Glaves *et al.* 2013).

Research by Penny Anderson Associates (2014) revealed that in England as a whole, almost 80% of 10km squares with breeding **merlin** (*Falco columbarius*) records from the 2008 third *National Merlin Survey* were located within grouse moors managed by gamekeepers. Furthermore, between 1988 and 2008 the percentage of breeding **merlin** records within kept grouse moors doubled from around 40% to 80%, but over the same 20 year period breeding **merlin** records outside grouse moors declined to 20%. These results demonstrate the importance of kept grouse moors for the English **merlin** population (Penny Anderson Associates Ltd. 2014). Other raptors may also fare better on grouse moors when they are protected, due to legal predator control carried out by gamekeepers (e.g. Baines *et al.* 2008), however illegal killing ('persecution') has been cited as the principal threat to **hen harrier** populations in the UK – this is explored in more detail in **Section 4.1**.

In terms of invertebrates, burning typically benefits open-ground species such as ground beetles and surface-active spiders, and is likely to lead to an increase in overall species diversity because of the increased structural diversity patchwork burning creates (Glaves *et*

al. 2013). According to the Moorland Association (2010), the late flowering heather plant also provides bee populations with a natural store of winter food, encouraging additional egg laying and improving overall bee survival rates through the winter (see **Section 3.4.2** for information on heather honey). Furthermore water vole (*Arvicola amphibius*) and amphibians benefit from other activities carried out by grouse moor managers (see **Section 3.2.2**).

3.1.3 Heather conservation

Heather moorland is rarer than rainforest (The Moorland Association 2010), and 75% of what is left worldwide is found in the United Kingdom (Aebischer *et al.* 2010; The Moorland Association 2010). This is arguably largely because of grouse moor management, which has been shown to be an important factor in retaining and conserving heather as a successional species of dwarf shrub.

A survey of 229 moors in Scotland investigated the extent of heather cover between the 1940s and the 1980s on moors managed for grouse and those on which grouse management had stopped. In areas where grouse moor management was maintained over time, heather loss was slowed compared to moorland where grouse moor management had ceased. The research suggested grouse shooting had provided an incentive to conserve heather despite economic pressures and the attractiveness of government subsidies for forestry and farming (Robertson *et al.* 2001).

Bardgett *et al.* (1995) investigated the extent and condition of heather on moorland in the uplands of England and Wales. They found that in north and south Wales, in addition to south west England, a large proportion of heather was suppressed or damaged. The authors proposed this was likely to be due to overgrazing, neglect or inappropriate management. However, in more northerly regions where vast areas of land are managed for grouse, the study showed heather was in better condition.

3.1.4 Heather management

A 2003 English Nature research report stated: 'It is evident from this, and other reviews that, in appropriate areas and circumstances, carefully managed burning can play an important role in the maintenance of some open semi-natural upland habitats in England' and 'maintain habitats of high conservation importance' (Tucker 2003). Burning of heather (also called 'muirburn' in Scotland) as a management tool is carried out to increase diversity of heather ages and structure for grouse: young, fresh shoots for grouse to feed on and older heather for cover and shelter (Chesterton 2009). Heather burning is also designed to increase nutrient content of forage, in addition to preventing a build up of old heather and the establishment of woody species (Tucker 2003), which helps maintain open, heather dominated landscapes.

Rotational burning on dwarf shrub heath produces heather stands in a mosaic of ages, halting the successive progression of heather through its various stages in life, where it would naturally develop from pioneer (6-10 years post-burn) to building (13-15 years post-burn), to mature (20-25 years post-burn) and finally degenerate (~30 years post-burn) stages (Gimingham 1975, cited in Grant *et al.* 2012).



Burning of upland heath is not just carried out for grouse shooting. For example, the RSPB recognise the value of controlled muirburn ‘to increase the suitability of the reserve for key breeding birds such as hen harriers, short-eared owls, merlins and curlews.’ Burning is used on a number of its reserves, including Loch Garten and Hobbister (RSPB *n.d.*^a; RSPB 2009). The RSPB also recommend burning regimes which produce a mosaic of heather age structures to support red grouse (RSPB *n.d.*), and mowing, burning and grazing of heather to encourage woodlark (*Lullula arborea*) and twite (*Carduelis flavirostris*) (RSPB 2004; RSPB *n.d.*^b). Burning is also a common practice used to improve grazing for agricultural purposes. Agricultural burns tend to be uncontrolled and cover large areas. Burning for grouse moor management, on the other hand, is typically more planned and controlled (Tucker 2003).

In their management plan template for grouse moor estates / SSSIs (developed by Natural England in association with the Moorland Association), Natural England acknowledge that: ‘Management of grouse moors through sensitive burning, bracken management and low intensity grazing can: create a mosaic of habitats important for nature conservation, provide nesting and feeding grounds for a range of native bird species, encourage and maintain a harvestable grouse population, and provide important grazing for domestic stock’ (Natural England & The Moorland Association *n.d.*). Davies *et al.* (2008) noted that although there is pressure in some areas to reduce the use of fire, prescribed burning can be used to protect biodiversity and achieve a variety of management objectives (see **Section 4.2**). Heather burning can also help reduce wildfire risk – see **Section 3.2.1**.



3.1.5 Control of invasive species, pests and disease

Grouse moor management helps to reduce the spread of invasive and potentially damaging species, such as bracken. Over 10 years, Moorland Association members have treated 65 square miles of invasive bracken to stop it swamping and killing other moorland plants and providing a breeding ground for ticks (The Moorland Association 2014). An RSPB research report (Grant *et al.* 2012) states: ‘Management that maintains a vigorous cover of competing species (as rotational muirburn aims to do) tends to limit, rather than encourage, the spread of bracken, with one long-term study in the Quantock Hills, southwest England, demonstrating that dwarf-shrub heath was more likely to have been lost to bracken if it was not burnt between 1938 and 1987 than if it was burnt at least once during that period.’

In addition to controlling numbers of predators such as corvid, fox, and stoat (*Mustela erminea*), grouse moor managers also help to control tick numbers to reduce tick-borne disease in grouse, which may benefit other species too. A method of managing tick-borne disease in red grouse is ‘tick mops’ (sheep are treated with an acaricide that kills ticks or prevents them from feeding). Such methods may benefit other birds in addition to grouse, such as waders (Mustin *et al.* 2012). As Grant *et al.* (2012) notes: ‘High levels of infestation with ticks have been found amongst wader chicks in some studies, with instances of associated mortality in curlew chicks... Thus, some species may benefit from measures to control tick numbers on grouse moors.’

3.2 Carbon and flood regulation

Regulating

The uplands are incredibly important. In addition to their unique biodiversity, peatland ecosystems capture and store carbon. Waterlogged conditions are a key feature of peatland carbon storage, as they limit the breakdown and loss of carbon via water and the atmosphere. Over the past 10,000 years, peatlands have sequestered around 5.5 billion tonnes of atmospheric carbon, accounting for more than half of the estimated 10 billion tonnes of carbon stored in UK soil, and dwarfing that stored in UK woodlands (around 150 million tonnes) (JNCC 2011).

Bare eroding peat is the worst scenario for carbon loss, and vegetation cover has an important role to play in keeping carbon locked up. Re-vegetation of bare peat is a key way to reduce carbon loss from upland soils (Best Practice Burning Group, see **Section 4.2**). Plants such as *Sphagnum*, important peat forming species, and heather (Ward *et al.*, 2015) help slow carbon release. Grouse moor management, in turn, has been shown to slow the loss of heather (Robertson *et al.* 2001) as explored in **Section 3.1.3**.

3.2.1 Prescribed burning, wildfire risk and carbon

Large stands of old heather which are not rotationally burnt pose a major fire hazard due to a significant build-up of fuel loads, and wildfires in such areas are more likely to i. be more intense and severe and ii. ignite peat, causing considerable damage and releasing large amounts of carbon (Davies *et al.* 2008). Regular burning reduces fuel loads - thus to some extent mitigating the risks of large and damaging wildfires (Allen *et al.* 2013; Tucker 2003).

Natural England's 2012 evidence review on managed burning cited evidence that fuel load and structure were critical factors in fire behaviour, and noted moorland managed by rotational burning appeared less prone to wildfire, although stated no studies were found to date that specifically provided evidence on the direct relationship between managed burning occurrence and wildfire severity in the UK (Glaves *et al.* 2013).

However in 2013, a study by Allen *et al.* provided a first single-site approximation to above-ground carbon balance between prescribed burning and wildfire frequency. The researchers modelled above-ground fuel load accumulation and carbon release under various wildfire return intervals, at a site in the Peak District. They found 'a clear interaction between prescribed-burning rotation interval and wildfire return interval', and:

- At 50- and 100-year wildfire return intervals, carbon losses were minimised by short prescribed-burning rotations. However, under a 200-year wildfire return interval, carbon loss was minimised by long rotation intervals where delayed regeneration was modelled.
- Under a 50-year wildfire return interval, 8-year prescribed-burning rotation intervals could reduce carbon loss by 22% or 34% compared with 25- and 50-year rotations, respectively.



The authors concluded that: ‘Long prescribed-burning rotations may minimise carbon loss at low wildfire return intervals. However, if wildfire incidence increases, more frequent prescribed burning is likely to minimize overall carbon loss’ (Allen *et al.* 2013).

In a letter to the chairman of Natural England in July 2014, the Chief Fire Officers’ Association (CFOA) Lead Officer on Wildfire set out the CFOA Wildfire Group position on prescribed burning. The letter said the consensus of the Wildfire Group was that: ‘Prescribed burning is a vital tool for the management of fuel loading and is considered by the Fire and Rescue Services (FRS) to be a critical component of their wildfire prevention plans.’ The letter also stated that alternatives to prescribed burning for managing fuel loads were not considered as effective in delivering the outcomes required by the FRS.

There is evidence to suggest that burnt plots of moorland are a greater net CO₂ sink than unburnt plots, as photosynthesis increases at greater rates than respiration (Ward *et al.* (2007), cited in Grant *et al.* (2012)), and heather burning (in combination with grazing) has been found to significantly decrease the magnitude of carbon released by uplands by up to 25% compared to unburnt areas. This is because the quantity of carbon released during the burning phase is less than that recaptured during the heather growth phase, and because older vegetation is significantly less efficient at sequestering carbon (Clay *et al.* 2010). Furthermore, burning can open up the canopy and remove thick layers of *Molinia*, allowing for *Sphagnum* growth and promoting peat building, resulting in yet greater carbon storage (Hamilton 2001). Finally, the char left behind after a fire is a more resistant form of carbon and so will add to further carbon storage by increasing the size of the refractory carbon pool (Lehmann *et al.* 2008).

As previously mentioned (**Section 3.1.4**), burning for grouse moor management is typically more planned and controlled than other types of burning (Tucker 2003). However, inappropriate burning, for example on too short a rotation (Clay *et al.* 2010), can result in net releases of carbon and negative impacts on water quality (Yallop & Clutterbuck 2009) and flood prevention (Dunn 1986). Burning is regulated by law, guidance and codes of practice, as well as being covered by cross-compliance regulations (e.g. Good Agricultural and Environmental Condition (GAEC) Standards 10). Defra’s Heather and Grass Burning Code (2007) gives detailed guidance on burning plans, where to burn and where not to burn, and

how to burn – for example, conducting ‘quick, cool burns’ which remove the dwarf shrub canopy but leave ‘stick’ behind. Moorland managers follow this voluntary code of practice, and since the revised code came into force in 2007 burning practice by moorland keepers has substantially changed with investment in fire fogging equipment to aid cool burns.

Further research in this area is needed, as for some environmental effects of burning, the evidence is equivocal (Worrall *et al.* 2010). It is therefore important that burning follows the already agreed and established, evidence-based practices in order to maximise the carbon sequestration potential of this habitat. A recent Leeds University study (Brown *et al.* 2014) has highlighted some environmental impacts of burning – see **Section 4.2** for more information.

3.2.2 Plugging drainage ditches and moderating flood risk

Upland areas in the UK are the source of 70% of the UK’s drinking water (Natural England 2009^c). In recent times, drainage and cultivation of peatland have encouraged the release of greenhouse gases into the atmosphere, however efforts to restore the damage caused by these activities are increasing (JNCC 2011). Grouse moor management is an important part of this restoration effort. Over 10 years, Moorland Association members have plugged 1,250 miles of moorland drainage ditches and created 4,485 mini moorland ponds that benefit insects, water vole (*Arvicola amphibius*) and amphibians, as well as catching sediment and slowing water run-off, reducing flood risk downstream (The Moorland Association *n.d.*^b). This also contributes to the rewetting of blanket bog, increasing carbon capture. Work in such areas is ongoing, and grouse moor managers are actively restoring peatland.

An RSPB report noted that ‘A number of studies have found that the installation of dams in drains raises the water table and slows down the water discharged through the drainage network... This in turn has been found to increase water quality by decreasing the DOC [Dissolved Organic Carbon] content of run-off and the discolouration by up to 69%’. The report also stated: ‘The way in which grouse moors are managed may have a role to play in moderating downstream flooding’ (Grant *et al.* 2012). See **Section 4.2** for more detail about peatland restoration and water quality.

3.3 Investment and support for communities, people, and conservation

Cultural

Supporting

3.3.1 ‘Less Favoured Areas’ and wellbeing benefits

A widely used definition for upland areas is land categorised as ‘Less Favoured Areas’, an EU classification for socially and economically disadvantaged agricultural areas. An ‘ageing’ population is a concern in the uplands in general, as many young people tend to leave in favour of lower-cost housing and higher wages elsewhere (Commission for Rural Communities 2010). Grouse shooting can encourage the retention of young people in upland



communities. McMorran (2009) used surveys and interviews to explore the benefits and impacts of the grouse shooting industry on two communities in the Cairngorms National Park, and found that 63% of respondents agreed that the grouse shooting industry contributed to keeping young people in the local area. In addition, 81% of respondents felt that grouse shooting was a strong part of the community's culture and heritage.

Grouse shooting is an inclusive sport. According to the Moorland Association, the average driven grouse shooting day brings 40 people of all ages and background together. There are an estimated 40,000 shooting visitors to grouse moors annually, and this figure does not include beaters, pickers up or spectators. The national efforts of beaters and pickers up (across all shooting types) amount to the equivalent of 14,000 full time jobs annually and driven game shooting days are more likely to attract higher numbers of spectators than other live quarry shooting disciplines (PACEC 2014).

These visitors to upland areas bring economic activity and tourism into typically remote and sparsely populated communities. Just over half (54%) of UK shooting providers in general are estimated to generate 'visitor nights' in the local area from those who shoot, come to help or watch, and stay in the local area overnight. The average number of visitor nights generated annually per provider was estimated to be 59 (PACEC 2014). The Moorland Association estimated that their members' grouse shooting activity in 2010 generated 6,500 paid for visitor nights (The Moorland Association 2014).

In upland areas, community cohesion is particularly important, as people and services are likely to be spread out. People living in the uplands tend to be connected economically, socially and culturally to not only the land, but also those who manage it. Some have roles as custodians of the land and its natural assets. Such stewardship is vital to continued delivery of public goods and services that the uplands provide (Commission for Rural Communities 2010). Grouse moor managers play a vital 'upland custodian' role, as mentioned in **Section 3.1.1**.

- **Support for local businesses:** The estate provides local jobs and income – both directly on site, and indirectly through the supply chain. Shooters usually stay for around five days on the estate or in a local hotel. Many suppliers used by the shoot come from within a ten to fifteen mile radius, and where possible supplies such as feedstuffs and vehicles are sourced locally. The estate works very closely with neighbouring estates, for example joint work between the keepers on predator control.
- **Support for local jobs and people:** There are three full time, fully trained keepers and one trainee keeper. There is also a full time gardener and full and part time housekeepers who provide refreshments for the shoot. The estate employs a forest manager and a squad of foresters who carry out work for the shoot as needed. The estate has over 220 houses, an integral source of housing for the local community.
- **Support for training and research:** The keepers have a range of necessary qualifications – from deer management to first aid, and from operating quadbikes to chainsaws. The gardeners too, have their own qualifications. The estate works with BASC and the GWCT to organise research and seminars.
- **Support for young people:** The estate supports young trainee keepers who are gaining work experience. The current trainee keeper is an apprentice attending the local college, completing a National Certificate (NC) in Gamekeeping and a Higher National Certificate (HNC) in Highland Gamekeeping. The estate works closely with local schools – including primary school field trips, talks from keepers, and open days for secondary schools and colleges. The estate has links with Barnardos' Get Ready for Work scheme.

Box 1: Case study of wellbeing benefits supported by a grouse shooting provider in Scotland. Summarised from PACEC (2014).

A case study of two upland communities with local grouse shoots showed that one of the most important community-level benefits of grouse shooting is the presence of gamekeepers and their families in the local community, and furthermore that the shooting-related custom they facilitated was crucial to sustaining some businesses over the winter period. In addition, children of gamekeeping families were referred to by survey respondents as contributing to the active retention of community services such as schools (McMorran 2009).

In many cases gamekeepers are in essence the 'eyes and ears' of the countryside. Gamekeepers can help support the police front line workforce, by raising police awareness of activity which may otherwise go unnoticed – such as illegal off-roading, rural theft and poaching. For example, BASC offers advice and support to all its members on poaching issues and setting up 'Poacherwatch' schemes, and has produced a 'Poaching of Game, Deer and Fish' booklet which is used by members and wildlife crime officers alike. Furthermore, BASC's head of game and deer management is a plan owner for the Poaching Priority Delivery Group in England and Wales.

The rich diversity of social and wellbeing benefits grouse shooting provides for people and communities, via jobs, investment, training, and social cohesion, are explored in detail in the *Value of Shooting* report (PACEC 2014), in the form of a case study of a grouse shooting provider. This is summarised in Box 1.

3.3.2 Employment and economic activity

A summary of research outputs from the Scottish Government's 'Environment - Land Use and Rural Stewardship' research programme (Scottish Government *n.d.*) described shooting providers in Scotland as falling into one of three categories, the main difference between the three types being the numbers of Full Time Equivalent (FTE) staff they employ:

- Highly commercialised sporting estates: 20.5 FTE staff on average
- Non-commercial estates: 1.5 FTE staff on average
- Estates with let shooting as a non-primary activity: 2 FTE staff on average

Grouse shooting has been estimated to support 1,520 FTE jobs in England and Wales annually (The Moorland Association *n.d.*^b). In Scotland, employment supported by grouse shooting has been estimated at between 1,072 jobs (Fraser of Allander Institute 2010) to 2,640 FTE jobs annually (Scottish Land and Estates & Scottish Moorland Group 2013). A conservative estimate of the number of jobs supported in England, Wales, and Scotland by grouse shooting might therefore be 2,500 – 4,000. Differences in how these estimates of employment activity were arrived at should be borne in mind, however.

Grouse shooting is one of the few uplands land uses which is not directly subsidised by the government (Thirgood *et al.* 2000). As George Eustice said in a response to a parliamentary question (20th February 2015, 224553): 'Payments under the Common Agricultural Policy (CAP) are not targeted at owners or operators of grouse moors'. Furthermore: 'The Rural Development Programme also supports various socio-economic projects but not any specifically relating to the owners and operators of grouse moors'. Much of the work conducted by grouse moor managers is therefore a 'free service' which saves public money on the basis of private investment (Commission for Rural Communities 2010).

It is estimated that grouse shooting, and the management carried out over moorland for the purposes of grouse shooting, had a total economic value of approximately £67.7m in England and Wales in 2010. Around £15.2m of this was spent on goods and services such as travel and accommodation, activities which support supply chains. An estimated £52.5m was spent on land management, and of this around 10% was for government approved agri-environment work to cover some of the cost of providing specific public goods. The rest was private funding (The Moorland Association 2011 and *pers. comm.*).

For Scotland, a 2010 report estimated that grouse shooting was worth around £23m in Gross Domestic Product (GDP) annually (Fraser of Allander Institute 2010). Another source estimated that grouse shooting generated over £30m per year in wages alone (Scottish Land and Estates & Scottish Moorland Group 2013). Combining the Moorland Association figures for England and Wales with those for Scotland allow the estimation that grouse shooting in England, Wales and Scotland is worth nearly £100m annually – however differences in how these estimates of economic activity were arrived at should again be borne in mind. Grouse shooting is clearly a strong incentive for investment in the UK uplands and remote rural areas.

McMorran (2009) (see **Section 3.3.1**) demonstrated that there were often substantial socio-economic benefits of grouse shooting at the local community level: 81% of respondents agreed that the community received benefits from the existence of the grouse shooting industry and 58% felt that grouse shooting was a major employer in the area. Indirect benefits

were also explored – from tick mopping and predator control for grouse benefiting farmers, to the local garage working mainly on estate vehicles, to local construction workers' main business coming from refurbishing estate properties. McMorran concluded that grouse shooting made a very significant contribution to the local economy, in terms of employment and benefit for local businesses.

3.3.3 Cultural benefits of conserving upland areas

Grouse shooting has been shown to require more conservation labour and habitat and wildlife management by area than other forms of shooting (PACEC 2006; PACEC 2014). Grouse moor managers are responsible for over a million hectares of upland Britain (see **Section 2.1**). PACEC (2014) data shows that conservation labour for general management of heather moorland, re-seeding heather, re-wetting deep peat and controlling bracken undertaken for grouse shooting in 2012-13, was equivalent to 314 full time conservation jobs. This is a known underestimate of total conservation labour FTEs, as other management categories such as predator control were excluded from this analysis, and grouse shooting also contributed to the 4,700 conservation FTE jobs amassed by general habitat management activities for shooting (PACEC 2014). In general, and across all types of shooting including grouse, shooting providers spend nearly £250m on conservation annually (PACEC 2014). Much of the revenue from let grouse shooting days is put back into the land – for example, via gamekeepers' wages, materials and equipment needed for conservation and management (The Moorland Association *n.d.^b*).

Upland regions are a nationally significant resource for people in the UK: most have landscape protection status (e.g. Area of Outstanding Natural Beauty), special conservation designations (e.g. Sites of Special Scientific Interest), and separate local governance arrangements (National Parks) (Williams 2011). In addition to game production and shooting, activities which take place in the uplands are wide-ranging: from agriculture to forestry; renewable energy to water catchment management; and quarrying to recreation (Natural England 2009^a). Ownership of moorland areas of the uplands is not always straightforward: more than one person may have the right to use the land for different purposes (such as grazing), leading to multiple land uses. Shooting estates and water companies own a great deal of moorland in England and therefore manage it with conservation in mind (Gaskell *et al.* 2010).



Moorland is also valued as a cultural asset. It is particularly prized for its sense of openness, and heather is a feature that contributes to the quality of the experience (Williams 2011). More than 90% of English grouse moors fall within a National Park or an Area of Outstanding Natural Beauty (AONB) (The Moorland Association 2010), but landscape quality would be affected in the uplands through scrub and bracken encroachment (Commission for Rural Communities 2010). Without grouse moor management, therefore, landscape quality would be affected.

According to the RSPB (*n.d.c*), the uplands host more than 100 million day visits a year. Visits to the uplands produce wellbeing benefits – physical (e.g. exercise) and psychological (e.g. recreation and relaxation). People’s experience of and reaction to upland landscapes tend to be strong, and generally people value them for their sense of ‘wildness’, heritage and openness in addition to species assemblages (Williams 2011). Without management for grouse, the uplands would look very different, and people would lose the enjoyment of the iconic, vast swathes of purple heather that characterise the uplands.

‘Willingness to pay’ (WtP) is widely used to assess how willing, and how much, people are willing to pay in principle for various aspects of our natural environment. Research suggests that between 46% and 82% of respondents to WtP survey questions were willing to pay to protect uplands national parks. The proportion of individuals who were willing to pay, and the amount they were willing to pay, varied according to who was being asked and how the survey was conducted. For example, in 1999 individuals were willing to pay between £3.10 to protect one moorland estate and £119 to protect 11 national parks (results based on 206 local residents and 344 visitors respectively) (Williams 2011).

3.4 Food production

Provisioning

Cultural

3.4.1 Game meat

Red grouse populations historically showed cyclical fluctuations, driven by a nematode parasite causing ‘boom’ and ‘bust’ years for grouse (GWCT *n.d.a*). The GWCT estimated that numbers of grouse shot annually between 1911 and 1980 had fallen by 82%. This decline was notably apparent after the Second World War and after the mid-70s in Scotland and Wales (GWCT *n.d.*). In recent years, grouse numbers appear to have increased, likely due to a combination of factors – from increased input into moorland management, and decreased heather loss, to a new form of medicated grit (GWCT *n.d.*). Estimates of annual grouse bag sizes vary. The latest estimate is 700,000 red grouse shot in 2012/13 in the UK (PACEC 2014).

The estimated annual value of game meat in the UK is £61 million, but it is at present, undervalued and under-utilised (for more information on game meat see BASC white paper ‘The role of shooting in landscape scale land management’.) Grouse is highly regarded as the ‘King of Gamebirds’. It is a particularly lean and nutritious meat: according to McCance and Widdowson’s *The Composition of Foods*, roast grouse has less than one third of the fat, double the protein, and up to four times more iron and calcium than roast chicken (Food Standards Agency 2002).



There is also a cultural element to the provisioning of grouse meat. Obtaining meat is an important motivation for shooting other grouse species in the US (Guttery 2011) and is likely to be a significant motivation for grouse shooting in the UK. Grouse is a respected and prized bird: it is seasonal, wild and when the season begins restaurants vie to be the first to have fresh grouse on their menu.

Game processors deal with locally shot produce and also receive it from elsewhere in the UK. A study into the production of game meat in the North East of England (Flying Fox 2006) found that of five game dealers in the North East, 132,000 grouse were available to dealers seasonally, of which 52% (68,000) were shot in the local region (Flying Fox 2006). The retail value for red grouse varies from around £6.50 to £12 per bird (data from Taste of Game). PACEC (2014) estimated that around 97% of edible quarry shot in the UK is destined for human consumption, with around 84% of respondents eating gamebirds in season. Overall, many respondents surveyed by PACEC indicated a general opinion that the popularity of game meat was increasing, and becoming more widely available in recipe books, in restaurants and in shops.

3.4.2 Heather honey

Heather management underpins the upland provisioning services. Those ‘provisioned’ commodities are not just grouse or other upland species that flourish on grouse, but also include heather itself. Heather is used to make heather honey: a unique product in colour, taste, and viscosity (Mitchell *et al.* 1954). Just as grouse is known as the ‘King of Gamebirds’, heather honey is referred to as the ‘King of Honey’ and some beekeepers move their hives onto moorland in autumn to produce it (The British Beekeepers Association *n.d.*).

4. DISCUSSION

Grouse moor management plays a vital role in providing UK uplands with a sustainable future of ecosystem service provision. The economic inputs, environmental labour and investment, and social aspects of grouse shooting in the uplands have a role in supporting, regulating, provisioning, and cultural ecosystem services. In particular, grouse moor managers act as custodians of the upland environment, and grouse shooting provides a large-scale workforce for voluntary landscape scale management. It is clear that management for grouse is particularly important in maintaining populations of waders in the UK, conserving heather and restoring peatland. Despite the obvious benefits of grouse moor management which have been outlined in this paper, all land use has impacts and research indicates drawbacks in some areas if best practice is not followed. These will be explored in more detail in the following two sections.

4.1 Adaptive management

Thirgood *et al.* (2000) and Tharme *et al.* (2001) noted that grouse moor management was beneficial in terms of biodiversity and conservation, with the exception of the illegal killing of raptors. Although research has demonstrated that hen harriers fare better on grouse moors when they are protected, due to predator control carried out by gamekeepers (e.g. Baines *et al.* 2008), illegal killing ('persecution') has been cited as the principal threat to hen harrier populations in the UK. When hen harriers reach high breeding densities, their predation on grouse has been shown to limit grouse populations (Elston *et al.* 2014; Thirgood *et al.* 2000; 2000^a; 2000^b), reducing grouse shooting bags and in some cases rendering shoots economically unviable, leading to their closure (Redpath & Thirgood 1997, in Thirgood & Redpath 2008). Much of this illegal killing has been proposed to be attributable to gamekeepers (e.g. Etheridge *et al.* 1997).

However for some incidents classed as 'probable' persecution, it is possible that hen harrier nests may have initially failed for natural reasons (e.g. prey shortage or predation) and proof of human persecution is not categorical (Fielding *et al.* 2011). Human-wildlife conflict requires evidence-based management (Thirgood & Redpath 2008). It is therefore vitally important that decisions and policy surrounding raptors are evidence-based. This is particularly the case considering that a reduction in management intensity, or other limitations on grouse shooting, would result in a host of unintended consequences⁴, including reduced economic investment in the uplands and a significant reduction in the conservation status of UK heather moorlands and upland waders (Sotherton *et al.* 2009).

Policies and processes are in place to enable balance in the countryside mirroring the Three Pillars of Sustainable Development. Land managers have access to a range of licences that permit landowners, occupiers and other authorised persons to carry out a range of otherwise prohibited activities against species of wild birds. Users of these licences must be satisfied that legal (including non-lethal) methods of resolving the problem are ineffective or impracticable. The licencing system can be used for reasons of conservation, public health and safety and economic impact.

Publication of the Hen Harrier Action Plan, which includes measures such as diversionary feeding of harriers, was held up for a time. The RSPB did not support Action 6 of the plan:

⁴<http://basc.org.uk/wp-content/uploads/downloads/2014/12/Grouse-moor-licensing-unintended-consequences1.pdf>



brood management (RSPB 2014). Brood management is a conservation tool which would be used when a ‘threshold’ on harrier density was reached. In such cases, young would be temporarily removed from a grouse moor, raised in captivity and released back into other suitable wild habitat once they had fledged. This technique has not been trialled in the UK with harriers but has been used successfully in France (Amar *et al.* 2000), and research has supported the idea that brood management may be a suitable strategy for hen harrier conservation in the UK (Elston *et al.* 2014; Redpath & Thirgood 2009; Redpath *et al.* 2010; Thirgood & Redpath 2008), and could help establish hen harrier populations outside their current breeding distribution (Thirgood & Redpath 2008).

Although brood management may be a suitable strategy to move forward with the raptor-grouse conflict, it is unlikely to be without its own challenges for stakeholders. Research suggests significant differences in what different interest groups consider to be ‘acceptable’ management strategies for harriers in the UK (Marshall *et al.* 2007; Redpath *et al.* 2004). Strategies which ignore the socio-economic benefits people obtain from grouse moor management are unsuitable, and central to mitigating this conflict is an understanding of what is acceptable to stakeholders, the recognition that compromises may be required to reach common ground, and the incorporation of both biological and social science research (Thirgood & Redpath 2008).

It is therefore crucially important that stakeholders work together on these issues, in order to surmount challenges, conserve raptors and retain the economic, environmental and social benefits of grouse moor management. Such an example of constructive dialogue would be the UK Raptor Working Group which encompassed a range of stakeholders including the British Association for Shooting and Conservation (BASC), who unreservedly condemn raptor persecution. The Group reported to government in 2000 with a range of recommendations to mitigate potential human-wildlife conflict, including ‘more support for good moorland management.’

4.2 Peatland restoration

The benefits of controlled heather burning were explored in **Sections 3.1.3, 3.1.4 and 3.2**. Although some studies suggest prescribed burning by gamekeepers had no significant effect on Dissolved Organic Carbon (DOC) concentrations in soil water or surface water (e.g. Clay *et al.* 2012), a recent Leeds University study (Brown *et al.* 2014) found negative impacts. The

research focused on five burned and unburned river basins in the English Pennines, and concluded that burning associated with grouse moor management had environmental impacts such as effects on peat hydrology, peat chemistry and physical properties.

Natural England's 2012 evidence review on the effects of managed burning (Glaves *et al.* 2013, see **Sections 3.1.2 and 3.2.1**) incorporated the preliminary results of the Leeds University study, and noted that moorland burning can result in increased water colouration or dissolved organic carbon in peatland watercourses, and that burning can affect carbon budgets above and below ground. The review also found that studies to date had produced inconsistent evidence, with both positive and negative effects of burning evidenced.

After Natural England's review, Defra's Best Practice Burning Group met for 'Bogathon' to discuss how to restore peatland and manage land use so its combined effects were positive overall. The group produced recommendations on peatland restoration. Bogathon covered a range of sites in Northern England and included representatives from the Moorland Association, RSPB, Yorkshire Water, the Coverhead Estate and the Heather Trust. The group adopted an outcome-focused approach, prioritising discussions on carbon, water, biodiversity, grouse and sheep. These discussions demonstrated that burning can be a valuable management tool as part of a peatland restoration regime. The group discussed improving the health and functionality of deep peat so it:

- delivers good water quality including associated biodiversity and drinking water
- keeps stored carbon locked up and locks up more through peat creation
- supports characteristic blanket bog plant communities
- supports sustainable agricultural grazing
- supports sustainable grouse shooting

The group agreed, amongst other things, that 're-vegetation of bare peat is the biggest 'quick win' for reducing carbon loss' and 'making a blanket bog more active through increasing *Sphagnum* species cover, where wet enough, is the silver bullet for water quality, biodiversity and carbon lock up and may act as a catalyst for colonisation by other species'. Bogathon demonstrated that in terms of management prescriptions, one size does not fit all, and that conservationists can work with landowners to agree and determine the optimum solution for achieving all objectives – which can be achieved with grouse shooting interests. Government's subsequent move to focus on outcomes rather than prescriptive management has been broadly welcomed.

Reed *et al.* (2010) noted that a range of options could be used to restore peatlands that had been damaged (e.g. through draining and inappropriate burning). These included 'ensuring that land managers have access to and capacity to use the latest restoration techniques; exchanging knowledge about new techniques and the relative performance of existing techniques; continuing to finance peatland restoration through existing schemes; and facilitating private funding of peatland restoration for carbon and other benefits'. The grouse shooting community is already working to restore peatland that has been historically damaged by government-incentivised drainage, for example by plugging drainage ditches – see **Section 3.2.2**. Peatland restoration partnerships are an illustration of stakeholders working together to restore peatland. An example of this type of project is the Yorkshire Peat Partnership, which receives support from a range of stakeholders such as the Moorland Association, the National Farmers Union and the Environment Agency. In 2013, the group reached a milestone, when they succeeded in restoring 10,000 hectares of peat.

The UK is among the world leaders in peatland restoration and the EU 2020 Biodiversity Strategy advocates sustainable ecosystem management and the balancing of ecological, economic and social functions of peatlands (IUCN 2014). Natural England's 2011 report on SSSI condition stated that one of the biggest achievements in the SSSI improvement programme had been the turnaround of grouse moor condition, which covered 17% of the area of all SSSIs. The burning code of practice, the blocking of drainage ditches and addition to the development of new management techniques by the Moorland Association and its members, had helped restore diversity on grouse moors. These factors, and the willingness of grouse moor managers to manage responsibly and sustainably (Natural England 2009^b), led to a rapid and substantial increase in the proportion of grouse moors in 'unfavourable recovering' or 'favourable' condition: from 25% in 2004, to 96% in 2011 (Natural England 2011). This achievement demonstrates the value of grouse moor managers as a conservation workforce.

It is clear that appropriate burning can have a range of benefits including retention of heather and improved biodiversity, particularly of wader species (see **Sections 3.1 and 3.2**). Natural England consent to allow grouse shooting activities over SSSIs and recognise that management of grouse moors through sensitive burning, bracken management and low intensity grazing (Natural England & The Moorland Association *n.d.*) can provide important biodiversity and land management benefits, such as habitat improvement (See **Section 3.1.4**). It is therefore important that, in order to maximise these benefits and allow the continuation of the economic, environmental and social values of grouse shooting, best practice is always used and burning practice adheres to the law, guidance and codes of practice and cross-compliance regulations which govern it.

4.3 Looking forward

Against a backdrop of climate change, increasing species range shifts and contractions, our rapidly expanding population and an ever-greater need for conservation, sustainability, and food security, grouse moor management is already well-placed to ensure a sustainable future for the uplands.

Quality food, and more of it, is becoming increasingly important. Maintaining and increasing production levels, particularly for game meat, requires wildlife management. Helping the UK to reach its biodiversity targets is of increasing importance. The (often voluntary) conservation, habitat and wildlife management undertaken by the grouse shooting



community is valuable to both biodiversity and the internationally important habitat of heather moorland.

The uplands need management, and if left unmanaged would become a degraded asset. As mentioned in **Section 4.1**, limiting or reducing grouse shooting would result in a variety of unintended consequences, such as reduced economic investment in the uplands and a significant reduction in the conservation status of UK heather moorlands and upland waders (Sotherton *et al.* 2009; also see **Section 3.1**). One of the most severe social consequences of cessation or reduction of grouse shooting would be reduced private investment, which may ultimately lead to an increasing likelihood of rural depopulation.

Grouse moor management is a cost-effective means of landscape scale conservation of upland biodiversity and habitats, yet least dependent on subsidy for the time and effort put into land and wildlife management. Thirgood *et al.* (2000) noted: 'Grouse shooting is one of the less extractive forms of land use currently practiced in the uplands and one of the few to exist with no government subsidy.' The importance of the grouse shooting industry to the local community can vary year on year, depending on grouse numbers and the levels of shooting and management activity undertaken (McMorran 2009). More recognition and support for the benefits of grouse moor management would therefore help it deliver more consistent and sustainable socio-economic and environmental benefits.

Policymakers and stakeholders should recognise and support the importance of wildlife management in ensuring a sustainable source of food for the future, and that the grouse shooting community represent a workforce who put time, effort and money into managing the uplands with far-reaching benefits. Such support might take the form of Local Enterprise Partnerships (LEPs) or equivalent schemes which help drive sustainable economic growth and support private sector growth. Grouse shooters and managers may also benefit from Payment for Ecosystem Services (PES) schemes, which involve payments to the stewards or providers of ecosystem services (Smith *et al.* 2013). See the BASC white paper 'The role of shooting in landscape scale land management' for more information on PES schemes and recommendations.

The British Association for Shooting and Conservation (BASC) unreservedly condemns all illegal activity, including raptor persecution. All stakeholders need to collaborate to ensure progress is made in the field of balancing grouse shooting and raptor conservation interests. For the conflict to move toward resolution, one thing is clear: All moorland managers should follow current best practice. BASC encourages all stakeholders to work together on evidence-based policy rather than a situation whereby, as Thirgood & Redpath (2008) suggest, 'the entrenched positions of stakeholders are the main barrier to progress', and 'scientific evidence is insufficient... if the political will is lacking to find solutions.'

The Langholm Moor Demonstration project, now seven years old, aims to reconcile grouse management and raptor conservation through re-establishing a driven grouse moor whilst maintaining a viable population of hen harriers, including diversionary feeding of harriers (GWCT 2014). At present the project has been a success in terms of raptor populations, which have exceeded their targets, however red grouse recovery has not been as successful. Predation by raptors was attributed to 78% of adult red grouse mortality. The project potentially has another three years to run and stakeholder engagement has been high, so has promise in terms of producing constructive ways of moving forward with raptor-grouse

coexistence in future (Langholm Moor Demonstration Project 2014)

Natural England's 'Vital Uplands: A 2060 vision for England's upland environment' report outlined a vision for 2060 uplands (Figure 3), which grouse moor management can help attain. The report also stated: 'Grouse moor managers, as owners of the majority of northern England's upland peat resource and heather moorland, have embraced the challenge of managing soil carbon resources sustainably. They have taken account of research outputs and modified their management where appropriate' (Natural England 2009^b).

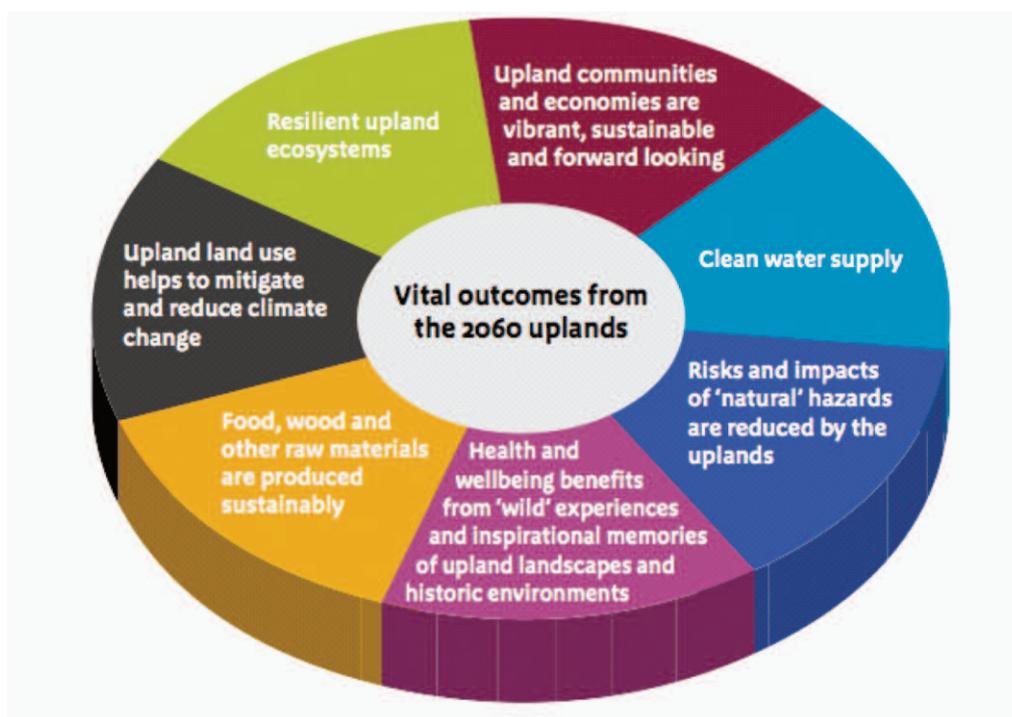


Figure 3: Natural England's vision for England's upland environment in 2060. From Natural England (2009^b)

5. CONCLUSIONS AND RECOMMENDATIONS

Grouse shooting is valuable for the UK's economic, environmental and social landscapes in ways which could not be replaced by other land uses. Grouse moor managers look after at least 1.3 million hectares of nationally and internationally important upland habitat, and manage this in a way that is beneficial to a range of species of conservation importance. In many cases, such species are thriving on grouse moors yet declining elsewhere in the UK.

Grouse moor managers are 'upland custodians' who invest vast amounts time, effort and money into conserving upland habitats, and this management is a cost-effective and sustainable way of maintaining and improving the ecosystem services provided by the uplands. One of the biggest successes in the SSSI improvement programme in England has been the achievement grouse moor managers have made in improving the condition of grouse moors.

In addition to the value grouse moor managers have as a conservation, peatland restoration and wildfire reduction workforce, grouse shooting brings a range of social and wellbeing

benefits to upland ‘Less Favoured Areas’ – from community cohesion, to investment, to jobs. Grouse shooting can also play a role in helping to reduce rural depopulation and provides a crucial source of shooting-related tourism in upland communities which is especially valuable in the ‘off season’. Yet grouse shooting also helps to bring non-shooting visitors to the uplands who come to enjoy the unique scenery grouse moor management conserves.

The red grouse is a respected quarry which provides a source of lean, quality, and wild meat. Optimising its harvest requires sustainable, responsible land and wildlife management and grouse moor managers should follow responsible best practice in all aspects of moorland management. Illegal persecution of raptors is not the answer and BASC condemns such incidents unreservedly. ‘Blinkered’ policy which ignores socio-economic aspects of grouse shooting and management is not the answer either, and could lead to a negative spiral of unintended consequences and diminish the economic, environmental and social landscape of the uplands.

Instead, evidence-based policy which considers grouse moor management in the round, by balancing its economic, environmental and social facets, is essential. The role and value of grouse shooting and grouse moor management in maintaining and improving the provision of ecosystem services should be recognised and supported. Stakeholders and policymakers should work with grouse moor managers to ensure ongoing and sustainable delivery of these services.

Recommendations

- **Recognition by policymakers and stakeholders** of the important positive contribution of grouse shooting to a sustainable future of conservation and ecosystem service provision for the uplands.
- **Appropriate support** to assist the creation and / or improvement of shooting enterprises in the uplands, and facilitate the route of grouse meat to market. Support and funding, for example via Local Enterprise Partnerships (LEP) or Payment for Ecosystem Services (PES) schemes, would i. help retain and maximise socio-economic benefits and market opportunities provided by grouse shooting such as economic activity, jobs and game meat production, and ii. support the provision of cultural, health and wellbeing benefits.
- **All stakeholders to come together**, engage in constructive dialogue, agree common ground and develop workable, pragmatic and evidence-based solutions to management challenges.
- **A joined-up approach** from the private and public sectors. A constructive dialogue between the grouse shooting industry, key governmental and non-governmental agencies, and local communities in grouse shooting areas, will help realise the potential of, and help mitigate any conflict surrounding, grouse shooting in the uplands.
- **Policymakers to work with the grouse shooting community** to produce supportive evidence-based uplands policy which follows the five principles of better regulation, considers socio-economic aspects and avoids unintended consequences.
- **All moorland managers to follow current best practice.**

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