Written evidence submission to the 2016 Petitions Committee inquiry into grouse shooting

Who we are

This submission has been produced by the Game & Wildlife Conservation Trust (GWCT), a research and education charity that has had 135 scientific papers published in peer-reviewed journals on issues relating to upland ecology over the past 46 years. On the basis of our scientific expertise and credibility, we regularly provide advice to such statutory bodies as Defra, Scottish Natural Heritage and Natural England. We also provide practical advice to farmers and landowners on how to manage their land with a view to improving biodiversity.

Much of our research is undertaken in collaboration with other institutions and organisations, including the following: Aberdeen University, the British Trust for Ornithology, the Centre for Ecology and Hydrology and the RSPB.

To help disseminate this knowledge, representatives of the GWCT sat on over 100 external committees in 2015, including the following: Defra's Upland Stakeholder Forum, Natural England's main board and the UK Birds of Conservation Concern Panel.

Why we have submitted evidence

After spending 46 years researching and advising in the uplands we support grouse moor management for three primary reasons:

1. The habitat management undertaken on grouse moors preserves and enhances heather-dominated habitats[1].
2. The package of management, notably habitat enhancement along with predator control, contributes to the conservation of a suite of upland bird species including upland waders[2-4]. This preservation of habitat and its wildlife thus stems national declines which have been driven by land-use change, predation pressure and climate change[1].
3. This is a land use which delivers high nature conservation value but is funded primarily by private investment and supports local communities economically, socially and culturally.

Executive summary

1. **Protecting habitat and species** (page 3)
    - As a consequence of red grouse relying on heather as their primary food source, grouse shooting is the only management system that explicitly maintains and enhances one of the rarest habitats in the world: heather-dominated moorland.
    - Do critics of grouse moor management agree that driven grouse moors have been successful in protecting these conservation priority habitats and species for the nation?

2. **Sustainability** (page 4)
    - Our moorlands are home to specialist flora and fauna and deliver a range of other public goods and services such as drinking water, carbon storage and recreation.
    - Do the critics of grouse moor management accept that there is always a sustainability balance between environmental, social and economic considerations?

3. **Funding for conservation** (page 5)
    - This complex and wonderful moorland habitat is enjoyed by millions of visitors each year, but it is on grouse moors, invariably as a result of the private investment, that they will see high numbers of curlew and other threatened species.
    - A ban on driven grouse shooting would result in a drop in the private investment in conservation by moor owners. Those proposing the ban should be challenged to explain how much additional government or charitable funding would be required.

4. **Alternative land uses** (page 6)
    - It is unlikely that these unique habitats and upland bird populations can be maintained at current levels, along with local economic and social factors without driven grouse shooting.
    - Those proposing changes to ban or restrict driven grouse shooting should be challenged to produce evidence of the net gain that the alternative land uses they propose will bring to society – economic, social and environmental.

5. **Selective use of evidence** (page 8)
    - The evidence for many of the criticisms made of red grouse shooting is far from clear, accurate or balanced. Further research, over the medium to long term, is required.
    - Supporters of a ban on driven grouse shooting should be challenged to explain the clear imbalance in their evidence. Secondly there is a failure to recognise the associated risks that may result from changes in practice.

6. **Additional regulation** (page 10)
    - The Defra hen harrier management plan and brood management scheme does address the conflict and should be given a chance to work where legislation has failed.
    - What measurable outcomes are those proposing greater regulation trying to achieve, and why do they feel the extensive existing regulation can't achieve them?

7. **Finding working solutions** (page 10)
    - Trialling Defra's proposed remedy to the hen harrier conflict is critical. Without the incentive of grouse shooting there is little motivation to maintain our heather moorlands, as evidenced on Welsh moorland when driven grouse shooting ended.
    - Are those calling for the banning or licensing of grouse moors to protect birds of prey more focused on processes than a workable solution?

1. Protecting habitat and species

Protecting heather

1 Heather-dominated moorland habitat supports many biological communities that are either only found in the UK, or are better developed here than elsewhere[5]. Thirteen of these communities are listed under EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna. This environment also supports a unique collection of bird species (an "assemblage"), which contains 18 species of European or international importance[6]. The 1992 Rio Convention on Biodiversity ratified the global importance of UK heather moorland[7].

2 Moorland is one of the UK's most distinctive landscapes and Britain and Ireland have been called "the world's greatest moorland countries"[8]. The UK is responsible for 75% of the world's heather moorland. Until the early 2000s heather cover was falling sharply in the UK and in some areas the habitat is being lost to forestry. The extent of our moorland and heath habitat now is only 20% of what it was in 1900[9].

3 Evidence suggests that the reason the UK has largely retained its heather moorland is due to the presence of management for driven grouse shooting[1]. Grouse moor management has arguably also improved the resilience of these dwarf-shrub heathers in the face of disease and pest species, e.g. heather beetle outbreaks[10].

Protecting species

4 Many birds do better on moors managed for red grouse than on less managed moorland. These include globally threatened species such as curlew and merlin but also; red grouse, black grouse, golden plover, lapwing, snipe, greenshank, buzzard, short eared owl and black headed gull[2,11,12].

5 Several studies have shown that curlew, our bird species of highest conservation concern, does better on grouse moors in terms of either abundance or breeding success, probably because of a combination of factors that benefit them, including predator control and heather burning[2-4,12,13].

6 A recent study of merlin divided England into 1km squares, and looked for evidence of breeding merlin. These squares were then correlated with a map of known grouse moors to see where merlin are breeding. 80% of squares containing merlin were found to be on grouse moors, with only 20% on non-grouse moors, so it is clear that grouse moor management helps provide a suitable nesting environment for these birds[14].

7 Without moorland management, these species would exist at much lower densities, in much less well-connected populations, leaving them at even greater risk of local extinction.

8 Our moors are the product of thousands of years of management by man. Forests were cleared, and vegetation maintained by grazing and burning to produce the heather-dominated heath landscapes that now exist. If all management ceased (including farming and forestry), heather would be lost from all but the highest and wettest areas and replaced with scrub and tree regeneration. Some species would benefit and some would decline, notably those that benefit from open landscapes.

9 **Do critics of grouse moor management agree driven grouse moors have been successful in protecting these conservation priority habitats and species for the nation?**

2. Sustainability

10 The International Union for Conservation of Nature (IUCN) states here that: "The core of mainstream sustainability thinking has become the idea of three dimensions, environmental, social and economic sustainability."[15]

11 Our moorlands are home to specialist flora and fauna and deliver a range of other public goods and services such as drinking water, carbon storage and recreation. They are no longer 'wilderness', having been subject to centuries of human influence, either direct or indirect[16].

12 There is a broad acceptance that moorlands are desirable because of these attributes, both for the services they provide and as a cultural landscape[17]. This comes with the knowledge that they represent a balance where some outcomes are better than others; for example, more curlews but fewer trees.

13 Grouse shooting is a significant part of the cultural and community life of often remote, rural areas. It is invariably driven by private investment, which generates significant financial activity and employment in some of the most economically challenged parts of the country.

14 The key to the future of our moorlands is to ensure that they are managed in such a way as to meet as full a range of demands as possible within this balance, without the ecosystem becoming permanently depleted or damaged. Hence, it is essential that driven grouse moors continue to maintain their grouse populations in balance with their objectives to maintain, and in some cases restore, the biodiversity and other environmental services on their moors[17a].

15 Because most other upland land uses do not absolutely depend on maintaining moorland, and because of the recent adoption of measures such as peatland enhancement by grouse moor owners[18], we believe this maintenance and enhancement is most easily achieved by harnessing grouse shoot management.

16 **Do the critics of grouse moor management accept that there is always a sustainability balance between environmental, social and economic considerations, and that moorlands are worth preserving?**

3. Funding for upland conservation

17 Grouse shooting is a significant motivation for private investment in the management of upland habitats and wildlife species, often at uneconomic levels. One of the benefits of driven grouse shooting was identified by the RSPB as the "significant investment in management and restoration of upland heath" here. This investment conserves the habitats and wildlife that are the subjects of statutory targets, such as blanket bog, dry heaths and black grouse[19,20].

18 In 2009, we surveyed 92 upland estates that managed for grouse shooting, finding that each spent over £56,500 per annum on routine countryside management[21]. As a further illustration, in 2012 the Langholm Moor Demonstration Project (with a combination of private, public and charitable funding) spent £227,000 on moorland management by five gamekeepers in one year[22]. Without private investment there would be a social and financial requirement on the public, through government and/or charitable funding, to maintain and enhance our upland habitats and wildlife.

19 **A ban on driven grouse shooting would result in a drop in the private investment in conservation by moor owners. Those proposing the ban should be challenged to explain how much additional government or charitable funding would be required to meet our statutory conservation targets.**

4. Alternative land uses to replace driven grouse shooting

20 Those supporting a change to the status quo should articulate their alternative solution before any decision is taken. This is because heather moorland and the associated peatlands in Britain are internationally important (1992 UN Rio Convention), and it is widely recognised here and here that grouse shooting has helped protect it.

21 The main alternative land uses to driven grouse shooting are listed below. Each one is either clearly associated with lower net sustainability, or the suggested environmental, social and economic benefits are poorly understood.

Forestry

22 Commercial forestry, as noted by the recent SNH-commissioned moorland review[10], not only fragments heather habitat but can also impede the hydrological function of nearby blanket bog; support an increased number of predators, which can impact ground-nesting birds; and escalate tick densities[23].

Sheep farming

23 Where more intensive sheep farming replaces grouse moor management, heather moorland can rapidly convert to species-poor grassland. The Berwyn Mountains in Wales have lost 46% of their heather moorland since 1946[24]. Moorland in Dumfries-shire lost an average 68%, and in one area 83%, of its heather between 1988 and 2009 in those areas where there was no grouse shooting[22]. Other impacts, such as, ground compaction, water quality and flood risk is poorly understood. Recovering heather moorland from grass is possible but better avoided as it is costly, disruptive on grazing patterns and time-consuming[22,25].

Abandonment

24 The 2016 State of Nature Report[26] identified one of the factors causing species declines as "Abandonment of traditional management, including grazing, burning and cutting, which is crucial for the maintenance of habitats such as heathland and grassland". The protection of traditional practices was enshrined in Principle 22 of the 1992 Rio Declaration; "local communities have a vital role in environmental management and development because of their knowledge and traditional practices."

25 Cessation of grazing, burning and predator management will affect the breeding success of vulnerable ground-nesting species[27] including hen harrier, as seen at Langholm Moor in southwest Scotland[4] and in the Berwyn SPA in Wales[28]. The economic output from moorland areas (tourism, hill farming and sporting) could also be significantly reduced.

26 Eventually, unmanaged moorland ceases to be moorland, and bracken, scrub and trees take over. These changes reduce the areas available to upland ground-nesting bird species.

Re-wilding and nature reserves

27 Nature reserves seeking to manage for heather moorland would typically have to seek public or charitable funding to replace the private investment[10] that grouse shooting delivers. Low input reserve management and explicit re-wilding could lead to a loss of those moorland habitats and their associated species with high international conservation value to scrub or woodland of lower value. Not only do these have different levels of biodiversity, but there would also be consequential but uncertain changes in terms of tourism and hydrological and carbon storage amenity[17].

Eco-tourism

28 Increasing eco-tourism is unlikely to have the capacity to replace on a widespread basis the economic activity generated by driven grouse shooting. In the Peak District, research shows that only 1 in 3 visitors spend any money during a visit and the average spend is only £9.65 per person per visit[29].

29 The simple presence of 'iconic' species does not guarantee an increase in tourism revenue. The Langholm Moor Demonstration Project (LMDP) created a high density of breeding hen harriers readily visible throughout the breeding season from public roads, and this was well known from media and internet coverage. However, there was no discernible increase in tourist activity or local income for the period of the project. (S. Lester & G. Dalby, personal communication, 2014).

30 Some eco-tourism already occurs in grouse shooting areas where millions of people are attracted by the cultural landscape it maintains[30]. An end to the associated management and its possible replacement by grass, scrub, forestry or wind turbines would be likely to put at risk the tourism that already exists.

Walked-up grouse shooting

31 Walked-up grouse shooting requires lower densities of grouse than driven shooting[31]. But if we seek many benefits from our upland land use and as few trade-offs as possible, it is not a real alternative. The walked-up season is short, the employment rate per shoot day low, and similar sport is available overseas. Thus the marketplace cannot value it highly enough to justify the full-time employment of trained staff who maintain heather cover and control predators of curlew, lapwing and golden plover.

32 The only scientific study of wildlife populations after a driven grouse moor has ceased to operate, but walked-up shooting continued, is in Wales and it shows dramatic declines of threatened species[28].

33 **Those proposing changes to ban or restrict driven grouse shooting should be challenged to produce evidence of the net gain that the alternative land uses they propose will bring to society – economic, social and environmental**.

5. Selective use of evidence

34 The evidence for many of the criticisms made of red grouse shooting is far from clear, accurate or balanced. Further research, much of it over the medium to long term, is required.

Heather burning

35 In 2016 an international group of scientists reported their concerns that some UK organisations were presenting evidence for moorland management damage that "bear only passing resemblance" to key research findings, and they suggested much of this contextualisation of issues, such as burning, stemmed less from the evidence of the environmental effects and more from attitudes towards patterns of land ownership[32].

36 Because heather burning takes place in small areas typically leaving over 85% unburned in a year and 65% unburnt for more than three years, many studies assessing the whole of a moor indicate an overall increase in biodiversity[10,33].

37 Criticisms of burning on moorland are often driven by concerns about the potential negative impacts of this practice on the functional integrity of blanket bog and, subsequently, water quality[34]. There remains contradictory evidence about the actual positive or negative impact of burning when longer time-scales are taken into account[35]. More research is needed.

Water quality, flooding and carbon

38 Historical records here show that many catastrophic flooding events happened in our uplands long before driven grouse shooting was invented.

39 The Natural England Upland Evidence Review found "no evidence was identified specifically relating to the effect of burning on watercourse flow or the risk of downstream flood events. If there are any effects, these are likely to be highly site specific"[33].

40 Moorland is already a key component in the delivery of drinking water. It supports our ability to meet climate change targets through carbon capture[17]. Best practice grouse moor management contributes to these aims by maintaining heather and peat cover, 're-wetting' peatland by filling in historically subsidised drainage ditches (grip blocking) and reducing burning where possible[36].

41 A note of caution: where peat has been rewetted it will not solve downstream flooding. Fully rewetted peatland is 98% water and the water table will be so high that there would be the likelihood of rapid runoff response[17]. Nevertheless, although opportunities for peatland restoration to modify runoff regimes are likely to be slight and uncertain, they should and are already being taken.

Causes of hen harrier mortality

42 The failure in hen harrier recovery is typically ascribed to illegal killing by gamekeepers but as the British Trust for Ornithology (BTO) recognises here: "Illegal killing is by no means the only factor that can impact on hen harrier populations in Britain." A Natural England report here lists six identified causes of hen harrier nest failure: fire, persecution, predation, lack of food to provision for feeding chicks, weather and infertile eggs. Wind farms also cause mortality.

43 A crude estimate of suitable hen harrier habitat indicates that 50% of this area is found outside grouse moors[37] yet illegal killing by gamekeepers is typically ascribed solely to the lack of hen harrier recovery. See example here.

Mountain hares

44 What might happen to the mountain hares that currently thrive on grouse moors would depend on what land use replaced grouse shooting.

45 The Mammal Society said: "Mountain hare numbers have declined locally where favourable habitat such as former grouse moors has been afforested or heather has been removed by excessive grazing. Young forestry plantations can support high densities of hares which sometimes cause significant damage to trees, but these high densities decline once the forest canopy closes, and the ground vegetation is diminished."

46 Our research would also suggest that without predator control and the maintenance of open moorland mountain hare numbers would fall, and likely become fragmented, increasing their risk of local extinction. It appears grouse moor management has driven our uniquely high densities of mountain hares, so grouse moor managers should be encouraged to take responsibility for maintaining this situation.

Tick control

47 The sheep or deer tick (*Ixodes ricinus*) also feeds on red grouse and other moorland birds, to which they can pass a virus called the louping-ill (LIV). At present grouse moor managers are effectively alone in driving a comprehensive programme of tick control to the benefit of livestock and wildlife. Others, including the RSPB, also view tick control as one of the benefits of driven grouse shooting here.

48 Ticks feed on other moorland birds. Although it appears that waders such as curlew do not contract LIV, excessive tick burden has been cited as a cause of mortality for curlew chicks[38]. It is known that high numbers of ticks attached around the face can be debilitating for the chicks of moorland birds. In one study 91% of curlew broods contained chicks carrying ticks at an average of 4.5 ticks per chick, and maximum of 64 ticks on one individual[39].

Worm control

49 Medicated grit, which is prescribed by veterinary surgeons, was invented by the GWCT to kill grouse gut parasites, thus reducing the fluctuations between years in grouse populations[40]. This allows moorland owners to invest confidently in the management package that protects habitats, species, jobs and culture. The medication in the grit is the same as is used to treat internal parasites in hundreds of thousands of upland sheep and cattle, and many captive birds of prey, every year.

Predator control

50 The effect on vulnerable species can be significant. In our experimental study curlew numbers were dropping by 17% per year the absence of predator control. When implemented, curlew numbers rose by 14% per year (after a lag period as the new chicks reached breeding maturity)[4]. We have calculated that the low breeding success seen on moors where predators were not controlled in this experiment could lead to a drop in lapwing and golden plover numbers of 81%, and curlew of 47%, after ten years[41]. Lethal predator control should only be undertaken at a level that has a positive impact on the population you are trying to protect. This can be seen as 'intensive' by some but removal of predators below this level is ineffective.

51 **Supporters of a ban on driven grouse shooting should be challenged to explain the clear imbalance in their evidence. Secondly, there is a failure to recognise the associated risks that may result from changes in practice.**

6. Additional legislation and regulation

Additional legislation

52 The hen harrier is already fully protected, yet is being killed because of a wildlife conflict that remains unaddressed[42]. The Defra hen harrier management plan and brood management scheme does address the conflict and should be given a chance to work where legislation has failed.

53 Since current legislation can be used to provide managed solutions to the few conservation conflicts that are present in the uplands we see no benefit in additional legislation.

Licensing of grouse moors

54 Many management practices used by grouse moors such as heather burning, predator control and medication, are already regulated by legislation and by the site-specific requirements of Natural England on designated sites[43]. Additional regulation has not been required to deliver the other considerable benefits being delivered by driven grouse moors.

55 We see no benefit in licensing grouse moors because it does not address the wildlife conflict between red grouse and hen harriers.

56 **What measurable outcomes are those proposing greater regulation trying to achieve, and why do they feel the extensive existing regulation can't achieve them?**

7. Finding a remedy to end the illegal killing of birds of prey

57 The conflict between grouse shooting and raptors is well understood. Our research has shown that raptor predation can not only cause a cessation of driven grouse shooting but may also suppress any recovery in grouse numbers to such a degree that driven shooting does not restart[44]. Without the incentive of driven grouse shooting, there is little motivation to maintain predator control or manage grazing pressure in the uplands[45].

58 We seek a balance where gamekeepers can be employed to maintain the habitat and low generalist predator numbers that benefit both grouse and harriers[42]. A number of new approaches and techniques are needed to resolve this conflict. Diversionary feeding of hen harriers has been tested for nine years. It did not work well enough, on its own, to resolve the conflict in monitored trials on Langholm Moor[22].

59 Thus the GWCT supports Defra's 2016 Hen Harrier Action Plan, comprising proposals to trial additional management options here. These trials, of nest and winter roost protection, translocation and non-lethal brood management, sensibly utilising adaptive management approaches that are available through the current legislation, have yet to start, but we remain engaged in the process of looking for practical solutions to this issue.

60 **Are those calling for the banning or licensing of grouse moors to protect birds of prey more focused on processes than a workable solution?**

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Supplementary written evidence from the Game & Wildlife Conservation Trust

Langholm Moor – Southern Scotland

1 Studies on Langholm Moor have provided much-needed evidence to both identify and resolve the conflict between the interests of driven grouse shooting and hen harriers. The first was the Joint Raptor Study (JRS). Between 1992 and 1997, hen harrier numbers rose from 2 to 20 pairs in six years on a driven grouse moor. Shooting was abandoned because the hen harriers ate over a third of all grouse chicks that hatched. With no grouse shooting, the local culture, economy and employment suffered and the control of generalist predators ceased. By 2003, 20 harrier nests were back down to 2, and numbers of breeding grouse and waders had more than halved[1]. Predation was identified as the most likely cause of the declines. Grouse moor managers felt their worst fears had just been proven – this was a real lose/lose situation.

2 The second study is the ten-year Langholm Moor Demonstration Project (LMDP), started in 2008 with five gamekeepers being employed to restore the driven grouse moor at a cost of £227,000 a year (£450,000 a year when capital and operational costs are combined). The gamekeepers demonstrated that diversionary feeding did not work well enough to allow both the recovery of harrier numbers and red grouse (for all work see here). The gamekeepers stopped working on the moor in the spring of 2016 and harrier numbers have remained above target levels in their absence in the first year post-keepering. There is no evidence to suggest these harrier numbers at Langholm are sustainable in the long term in the absence of gamekeepers. There is evidence, from the 1992-97 JRS, to suggest that harrier numbers may fall below the target again in the absence of gamekeepers.

3 Those choosing to make selective use of data (GRO0532) to suggest the current harrier population on Langholm Moor will thrive in the absence of gamekeepers should be asked why they have decided to ignore the long-term evidence from this site that they will not.

4 There is also strong evidence from the Isle of Skye that hen harrier breeding success can be limited by foxes[2]: "There was little evidence that adult hen harriers can successfully defend their young against an incursion by a fox either in daylight or darkness." Less than a year after gamekeepers stopped managing the moor, fox predation on nesting harriers has been captured on camera at Langholm in 2016.

5 A scientific study by the GWCT, published in the Journal of Applied Ecology[3], identifies that the control of predators such as foxes and crows, carried out to protect red grouse, can benefit one of our most striking birds of prey – the hen harrier.

6 **The long-term data predict that the current hen harrier population on Langholm Moor will fall now that gamekeepers are no longer managing the moor.**

Berwyn and Ruabon Moors – Northeast Wales

7 Elsewhere in the UK, there is a strong correlation between grouse moor management and the abundance and productivity of species such as lapwing, curlew and golden plover, which are otherwise increasingly rare.

8 The uplands of Wales once supported the most productive grouse moors in the UK as well as abundant populations of other birds. However, since the Second World War, almost half of the heather cover in Wales has been lost[4]. Since the 1990s, owing to disease, overgrazing and, from the moor owners' perspective, a lack of support from conservation agencies, grouse management has been all but abandoned and numbers of some of the more threatened upland bird populations have been in long-term, severe decline.

9 This was studied by the GWCT in the Berwyn Special Protection Area (SPA) in North Wales. The results recorded that between 1983 and 2002 red grouse declined by 54%. Over the same period, golden plover declined from 10 birds to 1, and curlew declined by 79% (not 90% as given in response to Q80)[5].

10 Our work at Berwyn was published, after peer review, and forms part of the scientific literature on this subject. Those seeking an end to driven grouse shooting may wish to dismiss it (Q27 and GRO0530) but the evidence stands. We also note that there is no suggestion from this group that numbers of some of the more threatened upland birds increased on these moors as a result of the cessation of driven grouse shooting.

11 At Ruabon Moor (NE Wales), predator control introduced as part of a commercial red-legged partridge shoot and then maintained for grouse moor restoration has, together with improved heather habitat management, been associated with an increase in lekking male black grouse from circa 20 in 1995 to 320 in 2015 (also recent increases in breeding curlew (from 8 to 16 pairs) and golden plover (from 0 to 3 pairs)).

12 Continued declines in all three species have occurred on otherwise similar sites in the adjacent Berwyn SPA (Ruabon is not in the SPA), where improved habitat management has been conducted, but without predator control. For example, in 2015 there were only five displaying black grouse and two pairs of curlew on the RSPB's flagship Vyrnwy reserve (SSSI, SAC, SPA).

13 **Critics of grouse moor management continually fail to provide data that refute the clear and substantial evidence that driven grouse moors can protect conservation priority habitats and some of the more threatened upland species for the nation.**

The Defra Hen Harrier Action Plan

14 The Plan was drafted by a wide range of organisations (including the RSPB), has been published, and is being implemented on the ground by those that support it, including the GWCT.

15 Some other organisations have stated that they could not support it until there has been an end to all wildlife crime. We note that this type of condition was not applied while other 'remedies' were trialled. Diversionary feeding, for example, was tested at Langholm for eight years (including years when the hen harrier population was declining) without applying this rule, and we see no reason to adopt it for the Defra trial.

16 **Those calling for the banning or licensing of grouse moors to protect birds of prey should be asked to explain why they are calling for these divisive and damaging actions when there are potentially workable solutions to be tested.**

Alternative land use

17 Those seeking a ban on driven grouse shooting (GRO0530) have suggested that a cessation of driven grouse shooting would not result in a change to forestry, windfarms or more grazing because most are designated protected sites. If that were the outcome, we are still faced with how to retain traditional management techniques, necessary to maintain these sites in favourable condition, including burning and high nature value grazing (2016 State of Nature Report), without any alternative economic land use other than eco-tourism. Langholm Moor has failed to attract tourism revenue, despite being publicly known to have a high number of hen harriers.

18 **Those proposing changes to ban or restrict driven grouse shooting have not produced evidence of the net gain that the alternative land uses they propose will bring to society – economic, social and environmental.**

Burning

19 The evidence on burning is highly contested; this is demonstrated by the high level of debate amongst 16 scientists from six nations in recent exchanges in the journal of the Royal Society, the world's longest-standing scientific society. They agree that more research is needed here. Examples of the wider debate include:

20 (a) Peat formation – As well as negative impact (Q12) there is also evidence that burning heather has a positive impact on the *Sphagnum* mosses that are important in peat formation[6]. The authors "found no evidence to suggest that prescribed burning was deleterious to the abundance of peat-forming species; indeed, it was found to favour them". So we can't, as suggested (Q20), use the scale of burning as a proxy for the scale of damage. Those claiming it causes extensive damage should provide data to support this claim.

21 (b) Dissolved Organic Carbons (DOC) – There is also some evidence that DOC levels are unaffected or decline where burning has taken place[7,8]. We note for clarity that DOC is not the same as "the brown colour you get in water", although critics appear to sometimes think it is the case (Q12). One paper specifically identifies that using colouration as a substitute measure for DOC is not reliable[9].

22 (c) Water table – Whilst the EMBER study suggests heather burning lowers the water table (Q12), others suggest it does the opposite[7,9,10]. The evidence that burning dries out peat bogs is contradictory. However, it is agreed that drains, dug to improve the grazing for livestock, can at least, in the immediate vicinity of the drain, dry out peat.

23 (d) Scale of burning – Other authors expressed concern that more burning, rather than less, should be occurring, to reduce potential fuel build-up and wildfire risk[11]. Recent evidence from the Peak District shows that burning is generally carried out in accordance with guidelines, with appropriately sized burns and only 0.9% area being burnt per year, well below the recommended 10%.

24 (e) Carbon budgets – Another review assessed that the evidence for overall carbon budgets is limited and contradictory[12].

Flooding

25 We continue to fail to find an extensive body of literature suggesting that heather burning will increase flood risk (Q14). No further evidence to support this claim has been provided. And government committee reports do not implicate increased burning in increased flood risk[13] (Q14).

26 Once again we note there are contradictory elements to the evidence (Q21-22). For instance, the EMBER study also suggests overland flow is less common on burnt peat than unburnt peat. For the lowest 80% of rainfall events, the lag period is greater on burnt areas, and there is no difference for the top 20% (heaviest storms). For the top 20% of storms, the hydrograph intensity is higher for burnt areas but the lag time is not affected. This means that the peak discharge (amount of water in the stream), is higher for these heavy storms, but it does not happen faster[14].

27 Beyond further work by the authors of the EMBER report, there is no new evidence provided supporting the implied suggestion (Q21) that wider opinion currently supports these views.

28 **Supporters of a ban on driven grouse shooting have failed to acknowledge the contradictory evidence on heather burning and flooding, which is possibly due to the complexity of the ecological system; with no clear evidence of risk, we are confident there is space and time for more research. More 'test and trial' on the ground is needed.**

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