



Summary Report - The socioeconomic and biodiversity impacts of driven grouse moors and the employment rights of gamekeepers



AGRICULTURE, ENVIRONMENT AND MARINE

Summary Report – The socioeconomic and biodiversity impacts of driven grouse moors and the employment rights of gamekeepers

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Contents

Acknowledgements	i
Contents.....	ii
1. Introduction	1
2. Policy Background	3
Grouse shooting in Scotland	3
Multiple benefits from moorlands	3
Recent scrutiny.....	4
3. Synopsis of ‘Phase 1’ research	5
Phase 1.1: Socio-economic impacts of driven grouse moors	5
Phase 1.2: Biodiversity impacts of driven grouse shooting in Scotland.....	6
Phase 1.3: Use of GIS/remote sensing to identify areas of grouse moors, and to assess potential for alternative land uses	7
4. Aims and Objectives	9
5. Part 1: Socio-economic impacts of moorland use - case studies	10
Background.....	10
Methods and caveats.....	10
Moorland use case study findings	12
Grouse shooting enterprises – key findings.....	12
Walked-up grouse shooting.....	12
Driven grouse shooting	13
Comparison of walked-up and driven grouse shooting.....	14
Alternative moorland uses – key findings	14
Forestry and woodland creation	14
Conservation	15
Deer stalking and deer management.....	16
Hill sheep farming	17
Renewable energy	18
Conclusions – alternative moorland uses	19
6. Part 2 - Employment Rights of Gamekeepers	22
Methods and caveats.....	22
Gamekeeper survey - key findings	23
The people	23
The job	23
Employment terms.....	24

Crime and abuse	25
Job satisfaction and outlook	26
Conclusion - Gamekeeper employment rights	27
7. Part 3- Mapping the areas and management intensity of moorland actively managed for grouse	29
Background	29
Improvements to the available data and methods.....	29
Caveats to the analysis	30
Summary Map	30
Mapping areas and management intensity - key findings.....	31
Confirming Phase 1 analysis.....	34
Opportunities for further research and stakeholder engagement.....	34
8. Part 4- Biodiversity considerations on grouse moors	35
Method	35
Biodiversity considerations - key findings	36
Conclusions - biodiversity	37
9. References	39

1. Introduction

This report provides a summary of the findings from the distinct pieces of research commissioned by the Scottish Government to **Assess the Socio-economic and Biodiversity Impacts of Driven Grouse Moors and to Understand the Rights of Gamekeepers** (CR/2019/01). This project was led by Scotland's Rural College (SRUC) and was undertaken by an experienced team of interdisciplinary researchers from SRUC and the James Hutton Institute.

This '[Phase 2' work](#) extends from the evidence generated during '[Phase 1' of this grouse research](#)', addressing some of the knowledge gaps regarding driven grouse in Scotland that were identified during the earlier research (Brooker *et al.*, 2018a) as well as gaps identified by the Grouse Moorland Management Group (GMMG, 2019).

Recent grouse moor evidence

[Grouse Moorland Management Group – Report to the Scottish Government](#) (GMMG, 2019)

Phase 1 - [Socio-economic and biodiversity impacts of driven grouse moors in Scotland: Summary Report](#) (Brooker *et al.*, 2018a).

- [Part 1: Socio-economic impacts of driven grouse moors in Scotland](#) (Thomson *et al.*, 2018).
- [Part 2: Biodiversity impacts of driven grouse shooting in Scotland](#) (Brooker *et al.* 2018b).
- [Part 3: Use of GIS/remote sensing to identify areas of grouse moors, and to assess potential for alternative land uses](#) (Matthews *et al.*, 2018).

Whilst the different parts of this research may appear disconnected at first, the common element running through the reports is moorland management. [Part 1](#) deals with the financial and employment impacts from moorland management activities that are largely determined by the objectives of the owners of the land. Much of the activity on the ground is undertaken by employed gamekeepers ([Part 2](#)) whose management techniques alongside owner motivations can impact on the extent and intensity of moorland management ([Part 3](#)) as well as the biodiversity impacts ([Part 4](#)). As such, each report focuses on a different part of a complex set of interrelated decisions, actions and impacts that stem from grouse moor and alternative moorland management.

The individual reports make few recommendations due to their focus on providing evidence. However, insights from this investigation reiterate the

complexities involved in assessing impacts of grouse moor management, particularly as grouse shooting is often embedded, or underpinned, by wider estate activities – some of which occur on the same moorland that grouse shooting takes place. Unpicking the socio-economic and biodiversity impacts specific to driven grouse remains a complex challenge and reiterates Professor Werritty’s sentiments regarding the challenges faced by the Grouse Moor Management Group: “*I had not fully appreciated the complexity of the issues involved... Grappling with the evidence in terms of raptor and upland ecology, environmental law, wildlife law and related police and judicial procedures, veterinary science, the socio-economics of Scotland’s moorland, and much more besides, has proved a major challenge*” (Professor Werritty, GMMG, 2019).

This report only summarises the four detailed topic reports outlined above that are outputs from this [‘Phase 2’ research](#)¹. As such **this summary should not be read in isolation from these reports** where the research methods, caveats and findings are provided in detail. The topic-specific reports produced during this research are available on the [SEFARI website](#)²:

Mc Morran et al., 2020 [Part 1: Socio-economic impacts of moorland activities in Scotland](#)

Thomson et al., 2020 [Part 2: The Employment Rights of Gamekeepers](#)

Matthews et al., 2020 [Part 3: Mapping the areas and management intensity of moorland actively managed for grouse](#)

Newey et al., 2020 [Part 4: Biodiversity considerations on grouse moors](#)

¹ All technical reports associated with Phase 2 are available on the SEFARI website: <https://sefari.scot/research/phase-2-grouse-research-socioeconomic-and-biodiversity-impacts-of-driven-grouse-moors-and>

² <https://sefari.scot/research/socioeconomic-and-biodiversity-impacts-of-driven-grouse-moors-in-scotland>

2. Policy Background

Grouse shooting in Scotland

The sport of shooting red grouse on heather moorlands is unique to the UK and has occurred since the mid-19th century. A ground nesting bird, the red grouse is fast and agile, and is considered to provide a testing game shooting opportunity. Today, productive grouse moors are mainly found in Scotland and the North of England, where moorlands are actively managed at different intensities by gamekeepers to provide these wild birds with favourable breeding and rearing habitats. Specific management activities include muirburn, predator control and the use of medicated grit to improve grouse health (Moorland Working Group, 2002).

There are three types of grouse shooting: driven, walked-up, and over pointers. Driven grouse shooting is the most intensive form and accounts for the majority of commercial grouse shooting in Scotland. The grouse shooting season runs from 12th August to 10th December each year. Unlike some other game birds, red grouse cannot be reared in captivity, meaning their numbers vary considerably between years, with weather, habitat, disease and predators all having potential impacts on numbers. Successful grouse rearing years provide greater opportunity to engage in shooting activities.

Multiple benefits from moorlands

Scotland's Land Use Strategy promotes an integrated approach to land management, with woodland regeneration, biodiversity conservation, carbon sequestration and recreation encouraged in moorland areas alongside traditional sporting activities (Scottish Government, 2016). Therefore, there is increasing pressure on land managers to deliver multiple benefits from moorlands, including the public benefits that these areas provide.

There have been questions raised about the positive and negative impacts of grouse shooting on biodiversity and other public benefits. While grouse moor managers and collaborators are taking active steps to reverse the decline of wading birds in Scotland³, concerns generally focus on large-scale culls of mountain hares on grouse moors, muirburn and the persecution of raptors. It is particularly the latter that has generated emotive reactions from the general public, conservation organisations and campaigners, and led to increasing pressure on politicians to address the issue.⁴

³ For example, through the [Working for Waders](#) initiative that began in 2017.

⁴ For example, the [Revive Coalition](#) call for reform of driven grouse moors and a [petition](#) submitted to the UK Parliament in 2016 to ban driven grouse shooting.

Recent scrutiny

There has been a growing public and political concern relating to the disappearance of golden eagles in Scotland. In 2016, the Cabinet Secretary for Environment, Climate Change and Land Reform asked Scottish Natural Heritage (SNH) to report on the issue. In May 2017, SNH published a commissioned report that studied the movements of 131 young golden eagles over a 12-year period, finding that more than 40 had disappeared in suspicious circumstances. The majority of cases were found to have occurred on or near to (within 2km) land that was managed for driven grouse shooting (Whitfield and Fielding, 2017). Indeed, in summer 2019, further, significant attention was brought to the disappearance of two golden eagles in Perthshire, with more calls being made for political action to regulate grouse moor management.⁵

When the SNH report was published, the Scottish Government specified the intention to establish a group (the Grouse Moor Management Group – GMMG), with a remit to look at “*the environmental impact of grouse moor management practices such as muirburn, the use of medicated grit and mountain hare culls and advise on the option of licensing grouse shooting businesses*” (Scottish Government, 2018). In the same month, the Cabinet Secretary also announced commissioning of research into the costs and benefits of large shooting estates to Scotland’s economy and biodiversity.⁶ A related Programme for Government commitment (2017-2018) also confirmed that a research project would be commissioned on the topic, alongside “*work in relation to protecting gamekeepers’ employment and other rights*” (Scottish Government, 2017).

These announcements by the Cabinet Secretary focused specifically on driven grouse shooting. The GMMG, chaired by Professor Alan Werritty, began its work in November 2017 to “*ensure grouse moor management [driven and walked-up] continues to contribute to the rural economy while being environmentally sustainable and compliant with the law*”. During the working life of the GMMG, ‘Phase 1’ of this research into the socio-economic and biodiversity impacts of driven grouse (Brooker *et al.*, 2018a) was completed and the GMMG considered the results. The GMMG’s [final report and recommendations](#) to Scottish Ministers was published in December 2019 (GMMG, 2019).

This ‘[Phase 2](#)’ of the socio-economic and biodiversity impacts research, along with the study of gamekeepers’ rights, provides new evidence that addresses some of the knowledge gaps identified during the [Phase 1](#) research and in the evidence collated by the GMMG.

⁵ See, for example, coverage in [The Guardian](#) (01.07.19).

⁶ Scottish Government news: [Golden eagle deaths](#) (31.05.2017) .

3. Synopsis of ‘Phase 1’ research

[Phase 1](#) of this research (Brooker *et al.*, 2018a) provided a review of the existing evidence regarding socio-economic (Part 1) and biodiversity impacts (Part 2) of driven grouse moor management and included primary research that developed a Geographical Information System (GIS) methodology for assessing the area and intensity of grouse moor management in Scotland (Part 3). Brooker *et al.* (2018a) provides a short [summary of Phase 1 research findings and recommendations](#) with more detailed findings and methodology found in individual topic reports (Thomson *et al.*, 2018; Brooker *et al.*, 2018b, Matthews *et al.*, 2018)⁷. As part of ‘Phase 1’, the limitations of, and gaps within, the existing research base relating to grouse moors were highlighted and suggestions on how further research could help provide a more robust evidence base to support policy decision making were made.

Phase 1.1: Socio-economic impacts of driven grouse moors

Thomson *et al.* (2018) reported a relatively narrow research base on the socio-economic impacts of driven grouse moors that policy decisions could be based on. Most of the socio-economic studies that existed on grouse shooting had been commissioned by representatives of the grouse sector, meaning those reading the research could be critical of the robustness and independence of the evidence base. Other criticisms of the evidence base highlighted in the report related to data collection biases, challenges in providing accurate data, and findings often being reported from a relatively small sample, making extrapolations challenging. Many of the studies were reported as now being relatively dated and therefore did not account for more recent changes in grouse moor management approaches.

The review pointed to evidence gaps and challenges related to accessing appropriate (private) data, and the challenges that estate managers / owners had in disaggregating estate data to specific activities, such as grouse moor management. There was recognition that part of the challenge in disaggregating data was that estate activities (sheep, deer, walked-up grouse, driven grouse, wind energy, tourism, conservation, etc.) were often not mutually exclusive – that is, they can all be done on the same piece of ground and managed by the same staff members. Most studies also failed to differentiate between walked-up grouse and more intensive driven grouse.

Within this research a brief synopsis of economic impacts arising from alternative land uses on grouse moor areas was provided. It recognised that some alternatives can be constrained by biophysical factors (e.g. land quality, climate) or regulatory factors (e.g. environmental designations, land use planning). A wide range of socio-economic impacts were found to occur for

⁷ See the SEFARI website for more detail: <https://sefari.scot/research/socioeconomic-and-biodiversity-impacts-of-driven-grouse-moors-in-scotland>

alternative moorland uses, but many were reported to rely on exchequer support to varying degrees.

One conclusion provided was that data collection was required on a range of **alternative moorland uses**, including driven grouse moor management, using a systematic data collection process that would enable comparisons to be made on a consistent basis. [Part 1 of this Phase 2 research](#) addresses this through a case study approach that utilised the same methodology to collate socio-economic data on a range of moorland land uses.

It was further noted that **gamekeepers** are an important group of land managers that were understudied and that developing a greater understanding of their drivers, concerns and motivations would likely be beneficial to better understanding the socio-economic impacts of moorlands and how employment terms may influence behaviours. [Part 2 of this Phase 2 research](#) undertook an anonymous survey of gamekeepers to better understand their employment rights and duties, as well as their motivations and perceptions of the industry.

Phase 1.2: Biodiversity impacts of driven grouse shooting in Scotland

Within the Phase 1 research, Brooker *et al.* (2018b) undertook an evidence review of the environmental impact of a number of management activities strongly associated with driven grouse shooting. This included: muirburn; grazing (sheep and deer); legal predator control; mountain hare management; and a review of ecosystem services delivery by driven grouse moors.

The review reported that **hare control** impacts were likely to be context dependent and influenced by the level of control, local and regional hare population status, and complex effects mediated through food webs. **Legal predator control** impacts were reported to be both negative and positive, resulting in changes in the combinations of species present on managed grouse moors.

Impacts of **muirburn** on biodiversity were considered diverse and could be positive or negative depending on a range of conditions including fire intensity. The review found that whilst muirburn can provide structural diversity to the moorland landscapes that is often associated with higher above-ground biodiversity, there was almost no published data on below-ground biodiversity impacts, and there was highly conflicting evidence on muirburn impacts on peatland biodiversity.

Grazing impacts depended on grazing intensity as well as the balance of different types of grazers (sheep or deer) but there was limited knowledge of the long-term impacts of grazing and how it can help or hinder grouse moor biodiversity, or indeed management impacts. Research was found to have rarely focussed explicitly on the impacts of driven grouse shooting on ecosystem service delivery and had focused on a small set of services (such

as water quality and carbon storage). There are likely to be many interactive effects on biodiversity and ecosystem services of management activities associated with driven grouse shooting.

The authors of the review recommended that controlled experimental studies are needed to examine management impacts on biodiversity and better understand the ecosystem services moorlands produce. However, implementing these recommendations was beyond the scope of the Phase 2 research. However, this 'Phase 1' biodiversity report provides the context and background to [Part 4 of this Phase 2 research](#), which uses published geo-spatial biodiversity data with enhanced GIS analysis to examine **biodiversity impacts of different intensities of grouse moor management**.

Phase 1.3: Use of GIS/remote sensing to identify areas of grouse moors, and to assess potential for alternative land uses

Within Phase 1 of the research, Matthews *et al.* (2018) utilised GIS and remote sensing to **estimate the extent, intensity and characteristics of grouse moors** in Scotland. This included an examination of the opportunities and constraints for alternative moorland uses.

Using the presence of grouse butts combined with evidence of strip burning of moorland heather, the analysis was able to identify a population of land holdings that were potentially involved in driven grouse shooting. Importantly, using this combination of data along with data on when grouse butts were established, it was possible to indicate where more intensive driven grouse management activity was being undertaken at a regional scale, as well as where management intensity had changed over time.

Driven grouse activities on land holdings were found to occur at a wide range of scales and circumstances, and as an apparently exclusive land-based activity or as part of a diversified holding. There were marked local variations in management intensity, with several areas identifiable in which management intensity was substantially higher than is typical for their surroundings.

It was reported that typically the Land Capability for Agricultural land containing grouse butts was low and that whilst a change to an exclusive use of this land as unimproved pastures was feasible, it was considered unlikely given reduced stocking of hill land on many farms. Improvement to permanent pastures was considered prohibitively costly as well as being unlikely to fit with proprietors' desires, as well as potentially conflicting with environmental designations.

Land capability for forestry on grouse moors was also low, but it was suggested that undertaking specific analyses of afforestation options using Scottish Forestry's forest management alternatives, where the mix of public and private benefits can be judged, offered greater scope for assessing future options. The need to avoid net carbon losses resulting from current or

alternative management practices was stressed and the need to integrate more sophisticated assessments of soils highlighted.

Some of the main recommendations from this Phase 1 research related to how specific aspects of the Phase 1 analysis could be improved and additional recognised evidence gaps could be addressed. In particular, it was concluded that updating strip burning maps using more recent imagery would provide greater insight to grouse moor management developments within the last decade. [Part 3 of this Phase 2 research](#) provides updated GIS and remote sensing analysis that enables more precise assessment of moorland areas, including insights into more recent changes in intensity of grouse moor management. This improved data was also used for the basis of the [Part 4](#) analysis (biodiversity impacts) within Phase 2.

4. Aims and Objectives

The aim of this [‘Phase 2’ research](#) was to build on the existing research knowledge base regarding grouse moors and to understand in more detail the employment rights, attitudes, motivations and behaviours of gamekeepers. The research has focused on providing new evidence on five key objectives relating to grouse moor management, with each reported separately due to their distinct focus. The specified objectives for the research were:

1. Examine the extent and impact of economic connections between grouse shooting estates and surrounding businesses and communities.
2. Evaluate the socio-economic impacts of alternative land uses for moorland and how they compare against land used for grouse shooting.
3. Understand the employment rights and benefits available to the gamekeepers involved in grouse shooting, as well as their working conditions, attitudes, behaviours and aspirations for the future.
4. Provide a more up to date assessment of the area of grouse moors in Scotland under management for driven grouse, mapping clearly the areas of moorland that are actively managed for grouse and the intensity of current management regimes.
5. Understand further the impacts of driven grouse shooting on biodiversity making use of more up to date estimates of grouse moor management intensity and linking it with the best available biodiversity data.

The findings from these four distinct pieces of research are presented below, with an explanation of the background, data caveats, methodologies and findings provided for each of the themed reports.

- Section 5 summarises the [evidence on the socio-economic impacts of grouse moors and alternative moorland uses](#) (Part 1 Report – undertaken by SRUC: p.10).
- Section 6 presents the key findings on the [employment rights of gamekeepers](#) (Part 2 Report - undertaken by SRUC: p.22).
- Section 7 provides an overview of the [GIS work undertaken to improve insights into grouse moor coverage and intensities](#) (Part 3 Report - undertaken by JHI: p.29).
- Section 8 provides a summary of the [relative presence of different species under different intensities of strip burning](#) (Part 4 Report - undertaken by JHI: p.35).

5. Part 1: Socio-economic impacts of moorland use - case studies

Background

[Thomson *et al.*](#) (2018) noted that the existing evidence base for the socio-economic impacts of grouse shooting and alternative moorland land uses is limited and dated. Phase 1 recommended that further research be undertaken, to investigate the impact of economic connections between grouse shooting estates and surrounding businesses and wider communities, and the economic impacts of grouse moor management at different shooting intensities. Phase 1 further recommended that an evaluation of the socio-economic impacts of alternative land uses for moorland areas be undertaken.

The key objectives which Part 1 of this research aimed to address were to: (i) Examine the extent and impact of economic connections between grouse shooting estates and surrounding businesses and communities; and (ii) Evaluate the socio-economic impacts of alternative land uses for moorland and how they compare against land used for grouse shooting. This section provides a summary of the [full technical report for Part 1](#).

Methods and caveats

A set of case studies were identified, informed by stakeholder input, to fit case study selection criteria that were developed to provide a diverse set of cases from across Scotland that include variety in enterprise scale, intensity and owner motivations. These included examples of driven grouse enterprises and alternative moorland land use activities, including walked-up grouse, forestry/woodland management, conservation, deer management, sheep farming, and renewable energy. While the case studies were selected systematically, they represent a relatively **small set of estate examples** drawn from a large pool of potential cases across Scotland and are not a representative sample of all enterprises of these types. As such, the results are only indicative of the types of socio-economic impact that arise from different land uses, meaning that care should be taken using the data to make broad conclusions about uses of Scotland's moorlands. The full list and number of case studies for each land use category are shown in Table 1.

A systematic approach was evolved to collate financial information from 24 examples of relevant estate-based enterprises (and three additional examples of specific woodland creation schemes presented as a component of the forestry case study), relating to: i) capital investments; ii) recurrent expenditure; iii) revenue streams; and iv) employment. Semi-structured interviews were carried out with estate owners/managers to provide the context for the activity in each case. The case studies research required the

collation of sensitive financial data and all landholdings were fully anonymised through the data storage, analysis and reporting phases. Using published reports additional information pertaining to the Langholm experiment was also summarised.

Table 1 Moorland use case studies with measures of scale/intensity

Moorland use (case study)	Number of cases	Case study characteristics
Walked-up grouse/ grouse over pointers	3 walked-up estates and 1 walked-up/driven transition	<ul style="list-style-type: none"> • Small (walked-up, no commercial shooting) • Small-medium (walked up, some commercial shooting) • Large (commercial walked-up shooting) • Walked-up estate which has developed driven shooting
Driven grouse	4 estates and 1 additional 'mini' case study showing costs of restoring a managed commercial moor	<ul style="list-style-type: none"> • Sporting estate (smaller, commercial focus) • Sporting estate (medium size, commercial emphasis) • Sporting estate (medium size, mixed commercial/private) • Sporting estate (large, commercial emphasis) • Sporting estate (example of re-establishing a driven moor)
Deer stalking/ management	3 estates	<ul style="list-style-type: none"> • Commercial focus (large deer stalking enterprise) (two estates) • Maintenance focus (medium size, deer management)
Rewilding/ conservation	2 conservation estates	<ul style="list-style-type: none"> • Mixed land-use focus • Primarily conservation focus
Forestry/ woodland creation	1 forestry enterprise and 3 woodland creation schemes in moorland areas	<ul style="list-style-type: none"> • Upland estate based mixed forestry enterprise (one example) • Specific examples of new woodland creation schemes established on moorland (3 scheme examples)
Sheep farming	3 estate-based sheep enterprises and 1 tenanted sheep farm	<ul style="list-style-type: none"> • Estate based sheep enterprise (part moorland based) (3) • Upland sheep farm (with moorland component)
Renewable energy	3 hydro scheme and 3 wind farm examples	<ul style="list-style-type: none"> • Hydro schemes (3 hydro schemes on grouse shooting estates) • Wind farm (3 moorland located examples)

The approach taken allowed for analysis of the sources of finance and the first round of local/regional/national expenditure to be identified, but it did not account for indirect economic benefits and/or the costs or benefits of positive (e.g. landscape) and negative (e.g. carbon release from muirburn) externalities arising from different land uses. Accounting for these aspects was beyond the scope of this research. Additionally, with a limited number of examples there was potential for specific cases to skew results. Figures for a specific land use (e.g. driven grouse) have been averaged across the related estate examples to derive estimates (including on a per hectare basis) for average land use costs and revenues.

The allocation of costs/revenues to case study land uses was based on estimates provided by the interviewees. These allocations were necessarily based on estimates which can change over time. Furthermore, not all of the examples were located wholly within the moorland zone. To increase the comparability of the forestry and woodland case study, additional examples

were identified and developed which relate to woodland creation on moorland sites.

Although land uses are presented as singular activities, they do not occur in isolation and invariably overlap considerably within estate contexts. Finances were commonly managed across an estate as a whole, with some land uses subsidised from other activities relative to their financial performance and relevance to the priorities of the landowner.

Moorland use case study findings

The results from the interviews, data collation and analysis are presented below. Summarised results are presented initially for walked-up and driven grouse shooting and then for each of the alternative moorland land uses. The summary data is shown for individual landholdings within each case study land use and alongside average figures. This is not intended to provide conclusive evidence for each moorland use – rather, it presents results from a selection of case studies that provided indicative estimates of the extent of socio-economic impacts arising from different moorland uses. The data summary is followed by a section outlining the main conclusions from the overall synthesis of the moorland use case study findings.

Grouse shooting enterprises – key findings

Driven and walked-up grouse shooting occur on the same types of moorland and the choice of the type of grouse shooting undertaken is heavily dependent on owner motivations, but is affected by the capital infrastructure in place (roads, grouse butts, etc.) and grouse density.

Walked-up grouse shooting

The case studies show that walked-up shooting was comparatively low ‘intensity’ (25 hectares per brace⁸ on average), with an apparent emphasis on maintaining traditional values and limiting the degree of active management. The total combined direct impacts (capital, running and staff costs combined) for walked-up grouse were relatively low compared to other moorland land uses at £13 per hectare.

Walked-up shooting also generated comparatively low revenues (£5 per hectare), operating at an average net cost across the case studies of £6 per hectare (or £35,000 at estate level). Walked-up shooting also had a comparatively low employment impact (1 full-time equivalent (FTE) employee per 4,700 hectares). Nevertheless, walked-up shooting (regardless of intensity) required a base level of activity/staffing and expenditure that was commonly facilitated through integration with other sporting activities (e.g.

⁸ A ‘brace’ refers to a pair of grouse.

deer stalking) and through subsidisation from other estate land uses or external income.

Spending impacts were predominantly local or regional, with an absence of local businesses related to the remote location necessitating regional or national level spending in some cases.

Driven grouse shooting

The case studies demonstrated that expenditure levels and impact from grouse shooting varies widely, linked to the size of the moorland and sporting operation and relative commercial emphasis as determined by owner motivations. Driven shooting required a sustained level of capital spending (equivalent to £8 per hectare, on average), and the total combined direct impacts (capital, running and staff costs combined) for driven grouse shooting (£38 per hectare) were comparable to (or higher than) other moorland land uses. Driven grouse shooting was a more intensive use of the moorland (compared to walked-up) and required 7 hectares per brace shot on average (the most intensive case only required 2 hectares per brace).

Driven grouse shooting operations generated substantial annual revenues in good years (over £250,000 for larger operations), although revenues were generally lower than spending levels, averaging £20 per hectare. However, income was highly cyclical, depending on the availability of shootable surpluses of grouse which was related to a number of factors (e.g. weather, parasites and predators). These findings confirmed those of previous studies that driven grouse shooting enterprises are rarely profitable as stand-alone land uses, because costs generally outweigh revenue, or at best result in a break-even position during good years. On-going net costs mean that driven grouse shooting is subsidised by other income streams, from on or off the estate.

The employment impacts of driven grouse enterprises across the case studies broadly reflected previous findings and indicated that, on average, 1 FTE is generated per 1,450 hectares. This represents a higher per hectare employment impact than other moorland land uses. In most cases, grouse shooting enterprises (and associated income) were seen as a key factor facilitating ongoing retention of core estate staff.

Reflecting findings from previous work, 60-80% of direct spending in the case studies occurred within the local or regional area. Importantly, in regions where driven grouse shooting is most prevalent, grouse shooting is likely to be of greater local importance as an employer (than in non-grouse shooting regions), and in relation to the local economy and community retention.

Comparison of walked-up and driven grouse shooting

Driven grouse shooting generally occurred at higher intensities (based on hectares required per brace shot), although all types of grouse shooting enterprises required healthy grouse populations and on-going active moorland management. Revenue levels from walked-up enterprises were considerably lower than driven grouse (both in total revenue terms and in relation to revenue generated per participant and per shooting day). As expenditure and staffing levels on walked-up enterprises were also lower, any shift from a driven to a walked-up enterprise would likely result in reductions in staffing and local economy impacts. Nevertheless, walked-up shooting was a valued complementary activity within mixed sporting enterprises that can be sustained at a lower cost than driven grouse, but was less economically viable as a stand-alone land use due to lower capacity to generate income. In terms of maintaining the related spending and staffing impacts, walked-up shooting was not perceived by interviewees as a viable alternative to driven shooting.

Key constraints identified in relation to both walked-up and driven grouse shooting included: (i) a decline in grouse numbers in 2018-2019, perceived as being linked with increased prevalence of pests (heather beetle and tick) and climatic factors; (ii) increased regulatory constraints; (iii) loss of heather habitat; (iv) political pressure and negative public perceptions; and (v) a general unreliability in revenue over the longer term.

Recent trends and perceived opportunities for both walked-up and driven grouse shooting included: (i) increased employment and investment linked partly with sustained demand for driven grouse shooting; (ii) reduced parasite burdens from the use of medicated grit and tick mopping; and (iii) increased training and professionalisation among gamekeeping staff. Wider opportunities identified included peatland restoration, integrated estate management plans and potentially limiting the degree of intervention in grouse moor management to gain public support.

Alternative moorland uses – key findings

Forestry and woodland creation

Forestry as a commercial enterprise is often less directly comparable to grouse shooting due to commercial forestry often occurring on lower ground or on sites with higher land capability. Nevertheless, the single forestry case study example illustrated some of the key features of forestry as a land use within an upland estate setting. These included relatively high capital costs (£41 per hectare) relative to ongoing running costs (£24 per hectare), with most spending and activity occurring during establishment and felling phases.

The intermittent nature of forestry activity results in periods of comparatively high income (relative to other moorland land uses), linked with either revenue from establishment grants and/or timber sales during felling periods. Recorded

revenue for the forestry case study was £53 per hectare, with income relatively evenly split between grant income (47%) and from timber sales (53%). Importantly, the recorded income from timber sales was not representative of the longer-term average. Over the longer term, grant income was also noted as more variable and funding of the forestry enterprise was likely to require cross-subsidisation from other estate enterprises.

Both forestry and new native woodland creation generally had lower employment impacts (outside of peak phases) on a per hectare basis than most other moorland land uses (with the exception of deer and walked-up grouse – both of which occurred over much larger areas). Additionally, spending impacts were less localised due to imported short-term specialist labour squads and the use of contractors.

Three additional case studies of native woodland creation were developed to assess costs and revenues for woodland creation on grouse moors. None of the schemes expected to generate income from timber sales but the projected income from the sale of carbon units was a significant additional source of revenue over the main growing phase for two of the schemes.

Two of the schemes showed net estimated costs of £144 to £166 per hectare over their life, or £9 to £11 over 15 years. Even with the high extrapolated running costs, one of the schemes was projected to return a net income of £1,183 per hectare (or £79 per hectare over 15 years).

Owners of the two most recent schemes viewed the current grant rates, combined with projected income from the sale of carbon, as ensuring new woodland creation was now an economically viable land use in upland settings, with the capacity to generate a profit on a projected annualised basis.

Despite the potential benefits of carbon revenues for new woodland creation, a variety of constraints to new woodland creation on grouse moors were recognised, including: (i) challenging environmental factors, deer browsing pressures and uncertain growth and tree survival rates; (ii) limited or no potential for returns from timber sales from woodlands created on poorer ground; (iii) liabilities for landowners relating to the uncertainties around ongoing costs and requirements to repay grants subject to scheme success; (iv) loss of ground to other land uses and increased cover for predators leading to increased grouse losses; (v) shortages of available trees to plant; and vi) a lack of confidence in the long term potential of carbon markets to generate guaranteed income, particularly on challenging upland sites.

Conservation

On a per hectare basis the average combined spending (capital, running and staff costs) on the conservation estate examples was marginally higher than for driven grouse (£39 per hectare). Notably, the overall proportion of

spending in the local area/region was marginally lower than for some other moorland land uses.

The larger of the two conservation case study examples demonstrated the potential for conservation to deliver a comparable (or higher) level of spending and employment impacts relative to other moorland land uses. This includes a capital spend component equivalent to, or greater than, a large sporting estate.

Revenues from conservation were comparatively low (£19 per hectare), relative to other moorland land uses (reflecting previous studies), with the exception of deer and walked-up grouse. Conservation management therefore generally operated at a net cost, despite benefitting from substantial public funding, with the case studies suggesting that over 80% of conservation revenue is from public funding. Common Agricultural Policy payments, in particular, were an important funding component for conservation management.

The case studies demonstrated that conservation, as a land use, was heavily dependent on ongoing public and/or other organisational or external private funding aligned with the conservation objectives of the estate. Nevertheless, as demonstrated on these case studies, the net conservation costs can be reduced through generating income from alternative sources, including renewable energy, tourism and sporting land uses (e.g. walked-up grouse) at low intensities.

Overall, conversion of management on moorland sites (i.e. including the cessation of driven grouse) towards a primary conservation goal is likely to be heavily influenced by owner motivations or a change in ownership, the availability of public funding, and the potential to generate long-term revenue streams from complementary activities to offset costs. Declines in other land uses may also result in opportunities for conversion, in parallel with the availability of payments for ecosystem services.

Deer stalking and deer management

The average combined spending (capital, running and staff costs) for deer case study enterprises was £12 per hectare, which was considerably lower than for most other moorland land uses. On average, annual capital investment was £2 per hectare, suggesting deer management can be maintained without major ongoing capital investment, providing the required infrastructure is in place.

Average revenues for the deer case study enterprises were low (around £5 per hectare), with higher revenues (£8 per hectare) for the examples where commercial stalking took place. Regardless of commercial orientation, deer operations operated at a substantial net cost (around £100,000 on average, or £5 per hectare) before any capital investment was accounted for, due to a

combination of the ongoing staffing costs and the low revenue potential (e.g. relative to large driven grouse shooting enterprises).

Although employment impacts for deer were comparatively low (averaging 1 FTE per 4,000 hectares), the very extensive nature of deer operations in two of the case study examples resulted in the retention of a substantial local deer-related workforce (5-7 FTEs).

The complementary aspects of deer management (e.g. in relation to woodland management) were perceived as a key strength. In practice, an integrated/shared staffing model across sporting activities (deer, grouse, fishing, etc.) enabled the estates to maintain a larger year-round staff team (of which the deer FTEs were one part), ensuring a high level of active management over large areas of ground.

In the absence of any available public funding, stalking income was a mechanism to supplement some of the deer management costs with the remainder funded by other sporting activities, wider estate income (e.g. from renewable energy), or direct owner contributions.

Key perceived constraints for stalking and deer management included: (i) low revenues and low availability of funding support for deer management; (ii) conflicting objectives within and between landholdings; and (iii) the administrative burden linked to deer management group requirements.

Perceived opportunities for stalking and deer management included: (i) improved collaborative working arrangements; (ii) increased uptake of habitat impact assessment; (iii) recognition of the potential for new hunting models (e.g. shooting in mixed habitat setting and woodland stalking); and (iv) generating income from wildlife tourism.

Hill sheep farming

Relative to other moorland land uses, the initial set-up costs and ongoing capital investment costs for sheep farming case studies were low, reducing the potential for local economic impact. However, average running costs, including staff costs (£36 per hectare), were comparable to other moorland land uses. Additionally, the average total spending impact (capital, running and staff costs combined) for sheep enterprises (£43 per hectare) were comparable to, or higher than, the per hectare impacts for most other moorland land uses (including driven grouse shooting).

Total revenues and returns per £1 spent in the sheep case studies (averaging £61 per hectare and £1.69 respectively) were relatively high compared to most other moorland land uses. Sheep enterprises generated a profit before capital costs of £25 per hectare, on average.

However, excluding CAP support, all of the sheep enterprises returned losses, with average losses of £15 per hectare before capital costs. The sheep enterprises were therefore heavily dependent on public support (66% of revenue on average) to ensure their financial viability.

The case study sheep enterprises generated around 1 FTE for every 1,800 hectares, a lower per hectare employment impact than for driven grouse. While the case studies suggest spending impacts are highly localised, economic and job creation impacts from sheep farming can vary widely.

Despite declines in livestock numbers, and being subject to the continuing availability of support payments, the complementarity of sheep farming in mixed estates contexts and the potential for supporting new agricultural entrants (due to low set-up costs), suggests it remains a viable moorland land use going forward.

Renewable energy

The renewable energy case studies demonstrated that, relative to other moorland land uses, renewable energy schemes generally require a high level of initial capital investment - averaging around £1.4 million for hydro schemes and significantly more for wind farms. For large-scale wind farms, this initial investment is commonly taken on by an energy company carrying out the development, resulting in long-term rental payments to landowners.

Ongoing annual running costs for hydro schemes were comparatively low (averaging £37,000 across the case studies) relative to the initial investment costs. Cost-efficiencies can influence the scale of renewable energy schemes, with the cost per kilowatt generally decreasing as size increases, with fixed cost elements remaining similar between smaller and larger schemes.

Relative to running costs, the revenues from the hydro scheme and wind farm case studies were comparatively high when compared to other moorland land uses, with the hydro scheme case studies generating an average of £190,000 from energy sales and subsidy payments on an annual basis - the highest overall returns per £1 spent of all the case studies (particularly when initial capital costs are repaid). Additionally, the wind farm examples generated the highest overall returns (from rental payments) on a per hectare basis (£217-£272), although this fell to £49-£61 when calculated on a whole estate basis.

Renewable energy development represents a potentially significant source of reliable revenue to landowners over the long-term, relative to other moorland land uses. In several of the wider cases within this report, income generated from renewable energy schemes was perceived by interviewees as a key component of ensuring long-term estate financial viability.

While employment impacts (following the initial development) are comparatively low for hydro schemes, wind farms can generate employment

impacts comparable to other moorland land uses and the wider regional economic impacts of the wind farm development phase can be considerable.

Key perceived strengths and opportunities relating to renewables enterprises included: i) improved estate access/infrastructure as a result of the renewable energy development; ii) the development of community benefit funds as a result of large renewable energy installations; and iii) compatibility between renewable energy developments and other land uses including agriculture and grouse shooting.

Conclusions – alternative moorland uses

Table 2 provides a comparative overview of the key costs, revenues and staffing levels for each of the moorland uses examined through these case studies. The importance of the wider context of these stand-alone enterprises should not be under-estimated as the owners of businesses did not consider each type of land use in isolation. Instead, they contributed to a holistic estate business model.

The case studies show that grouse shooting can generate significant economic impacts for communities, with impacts generally localised and disproportionately important in regions where grouse shooting is most prevalent. However, grouse shooting enterprises are rarely profitable in their own right and commonly exist as part of an integrated, mixed, sporting enterprise. Spending and staffing occur across these enterprises, which are also integrated financially with the wider estate business, with more profitable aspects often subsidising less profitable activities.

Alternative moorland land uses were also shown in the case studies to generate comparable spending and revenue impacts (and in some cases more consistent revenue) to driven grouse shooting on a per hectare basis. Moorland land uses are not mutually exclusive and are often at least partially integrated, and the level of direct comparability of 'alternatives' can vary.

Native woodland creation offers scope for biodiversity and carbon gains and has the capacity to generate a profit over a rotation on suitable moorland sites. The availability of carbon revenues has the potential for altering the economic viability of woodland creation on moorlands, although uptake may be constrained by site constraints, perceived conflicts and uncertainty.

Grouse shooting is perceived as facing increasing regulatory requirements, as well as longer-term uncertainty around climate change impacts, although sustained market demand, capital values and owner motivations remain significant drivers for retaining driven grouse. Wider drivers for alternatives include the availability of carbon revenues, favourable grant rates for woodland creation and peatland restoration, a continuing emphasis on renewable energy, and wider market shifts (e.g. increasing demand for nature-based tourism), all of which have potential for influencing land use change.

Landowner motivations and how these reflect ownership change or succession are a further factor potentially influencing future retention (or not) of grouse shooting.

A widespread transition away from driven grouse towards woodland creation would likely result in job losses in some regions. A wider shift towards conservation and woodland restoration may also result in decreased levels of private owner investment in some rural economies. The case studies demonstrate that some of these losses could be offset through tourism development (and visitor spend), and the ongoing need for deer management suggests some retention of gamekeeping roles, particularly where estates have already developed diversified enterprises to offset costs.

A significant moorland transition towards conservation, native woodland restoration and/or high nature value farming, also implies a shift in the balance of public-private investment (or increased funding from organisational memberships or wealthy individuals), at a time of increasing pressure on public budgets. Any loss of sporting revenues is also likely to increase funding requirements for essential deer management, necessitating either further internal estate cross-subsidisation, or public support. The role of emerging markets for ecosystem services is also likely to become increasingly important in the long term.

Table 2 Comparative socio-economic indicators for the moorland land uses derived from case studies

Impact	Walked-up grouse	Driven grouse	Forestry	Woodland creation ⁹	Conservation	Deer stalking	Sheep	Renewables - Hydro ¹⁰	Renewables - Wind
Case study enterprises	4	4	1	3	2	3	4	3	3
Average annual capital costs	£10,465 (£2/ha)	£59,096 (£8/ha)	£173,000 (£41/ha)	£32,924 (£151/ha)	£153,815 (£10/ha)	£45,624 (£2/ha)	£16,341 (£7/ha)	£1.4m (build cost); (£93,444 over 15yrs) (£4,024/kW)	£89m (developer) costs (n/a)
Average running costs (incl. staff costs)	£61,247 (£11/ha)	£219,292 (£30/ha)	£102,056 (£24/ha)	£26,548 (£122/ha)	£480,284 (£29/ha)	£182,813 (£10/ha)	£87,019 (£36/ha)	£37,172 (n/a)	Est. £4.8-5m for larger examples (n/a)
Average revenue	£26,281 (£5/ha)	£147,916 (£20/ha)	£220,000 (£53/ha)	£63,039 (£290/ha)	£313,816 (£19/ha)	£87,826 (£5/ha)	£146,971 (£61/ha)	£192,280 (£552/kW)	£334,000 (£245/ha wind farm or £55/ha estate)
Hectares per FTE	4,685	1,446	4,000	n/a	2,100	4,005	1,793	n/a	n/a
Net balance (before capital)	-£34,966 (-£6/ha)	-£71,375 (-£10/ha)	£117,944 (£28/ha)	£36,491 (£168/ha)	-£166,468 (-£10/ha)	-£94,987 (-£5/ha)	£59,952 (£25/ha)	£148,878 (£428/kW)	n/a
Net balance (capital included)	-£45,431 (-£8/ha)	-£130,472 (-£18/ha)	-£55,056 (-£13/ha)	£3,567 (£16/ha)	-£320,283 (-£20/ha)	-£140,611 (-£7/ha)	£43,611 (£18/ha)	£92,606 (£266/kW)	n/a
Average revenue (%) from public funding ¹¹	0%	0%	47%	86%	79%	0%	66%	69%	n/a
Level of local-regional spending	Moderate/High	High	Low/Moderate	Low/Moderate	Moderate/High	High	High	Moderate/High	Moderate
Revenue per £1 spent	£0.43	£0.67	£2.15	£2.37	£0.65	£0.48	£1.69	£1.93 (£4.43 after payback)	n/a

⁹ Data relates to annual costs and revenues averaged over 15 years. Average annual costs and per/ha costs are considerably lower over a full rotation.

¹⁰ Average annual running costs and revenues exclude the initial capital costs – but the net balance including repayment of capital investment is shown over 15 years.

¹¹ The public funding contributions only relate to the specified land use and **a low or zero percent figure does not imply that the estate within which the land use/enterprise sits did not receiving any public funding in relation to other activities (e.g. farming, conservation)**. Furthermore, some estate land uses which may receive public funding (e.g. sheep grazing) overlap with, complement, and form part of the management of the moorland area over which grouse shooting and other activities may take place. Landowners may also receive public funding for deer fencing but this is generally recorded as relating to forestry management as opposed to deer revenues.

6. Part 2 - Employment Rights of Gamekeepers

In 'Phase 1', [Thomson et al.](#) (2018) noted that grouse shooting and related activities are important to some remote and fragile local economies. The 'Phase 1' evidence review of socio-economic impacts of grouse moors suggested that around 2,500 FTE jobs (both direct and indirect) were reliant on the grouse moor sector in 2009, with £14.5 million spent on wages related to grouse moor management and support activities. Thomson *et al.* (2018) recommended that there needed to be *“independent research to engage with gamekeepers on motivations, behaviours and support needs...this important group of land managers are understudied and developing a greater understanding of their drivers, concerns and motivations would likely be beneficial.”*

Fulfilling a Scottish Government commitment to undertake *“work in relation to protecting gamekeepers' employment and other rights”*, this report provides evidence on the working lives and employment rights and benefits of gamekeepers, stalkers and ghillies across Scotland, with key findings specific to the driven grouse sector drawn out where appropriate.

This Phase 2 survey of gamekeepers was one of the first independent attempts to investigate the profession and develop a profile of the people involved in the sector, their terms and conditions of employment and opinions they have on issues that impinge on their working lives. This section provides a summary of the [full technical report for Part 2](#).

Methods and caveats

An independent, online survey was conducted by the research team and disseminated by the Scottish Gamekeepers Association (SGA) and the British Association for Shooting and Conservation (Scotland) (BASC) to their members. The survey was open from early December 2019 until early February 2020. 152 responses were received, which is estimated to be a response rate of 10%-13% of the population of gamekeepers, stalkers and ghillies in Scotland.

It is acknowledged that only the views of those gamekeepers, stalkers and ghillies that chose to participate in the survey are provided and that views of the wider public, or those with competing ideologies, are not presented. Further, a number of biases inherently exist within surveys of this type, including voluntary-response bias, social desirability/response biases, under-coverage or non-response bias (from non-SGA and non-BASC members, those without internet access, or uninterested in the topic). Whilst the stakeholder members of the Research Advisory Group agreed that the survey findings were representative of the sector, the findings should be viewed with these caveats in mind.

Gamekeeper survey - key findings

The people

The gamekeeping profession is significantly male dominated (95% of survey respondents were male). There was good geographical representation in the survey responses, with two-thirds coming from the Highlands and Islands and the North East of Scotland. Half the respondents were over 50 years of age (with 25% being 60 and older), a third were aged 30-49 years of age whilst 13% were under 30.

A quarter of the respondents held the position of head keeper, with 18% beat keepers, 15% deer stalkers and 14% single-handed keepers. There were also some semi-retired and self-employed keepers. For many, being a gamekeeper, stalker or ghillie was considered a 'vocation' rather than a job per se, particularly where there were familial links to the profession – an occurrence for over half the respondents.

For most, there was considerable 'practical experience' from a 'lifetime' in the job, with 60% of the respondents having more than 20 years' working experience in the profession. Only 11% of the respondents had no formal training pertaining to their job, whilst nearly 50% had a further education qualification and 25% a higher education qualification related to gamekeeping. Gamekeeping apprenticeships had been completed by 14% of the respondents and 63% of respondents receive on-the-job training. On-the-job training and qualifications regularly reflected legal obligations or best practice, such as Deer Management Qualifications, all-terrain vehicles, chainsaws, etc.

The majority (87%) of the respondents lived with a partner / spouse and 34% lived with dependants at home – with an average of two school age children each. Only 16% of these partners / spouses were not economically active – and 18% also worked in the same business as the gamekeeper respondent. For nearly a quarter of respondents living with a partner / spouse, the gamekeeper respondent provided less than half of the total household income (excluding non-pecuniary benefits such as tied housing that is a common feature).

The job

Three-quarters of the respondents worked solely on private estates, with 8% working on private estates in conjunction with other types of business / agency. A higher proportion of the respondents who were undertaking driven grouse tasks were working for / owned sporting agencies or were sporting tenants (23%).

Game and wildlife management activities were often undertaken within teams on estates and only 17% of the respondents were the sole game and deer manager at their workplace. Those with driven grouse moor roles were much more likely to have large numbers of co-workers, with 52% reporting that they had more than five other full and part-time game and deer management colleagues, with nearly a third reporting 10 or more gamekeeper colleagues.

On a day-to-day basis, the head keeper provided daily instruction for 25% of the sample, whilst only 19% took instruction from the owner of the estate / business that they worked for, with 9% being directed by a factor / land agent responsible for decision making. The role of the head keeper in providing direction to other keepers was more important for those with driven grouse work. For those receiving daily instructions, a third of the decision makers were non-resident on the estate / business.

Taking an average across the whole sample, respondents reported that they worked 63 hours per week during peak working periods and 41 hours per week during off-peak periods. The roles played are highly variable and individual keepers have their own unique blend of roles throughout the year:

- 78% were engaged in deer management - this was over 60% of their time for 21% of them.
- 76% undertook general estate work.
- 74% were actively involved in pest control for farming and forestry.
- 61% had non-grouse game bird (such as pheasants and partridge) management roles.
- 44% were involved in driven grouse work - for 22% this was for over 60% of their time.
- 36% were involved in walked-up grouse activities.

For the 83 respondents that were engaged in grouse shooting to some extent, the grouse work undertaken was exclusively driven for 35% of this cohort of respondents whilst 25% were only engaged in walked-up grouse and 45% were involved in both driven and walked-up activities (remembering they also have other non-grouse activities to undertake). Walked-up grouse tended to be more commercially focused with over half of those involved in driven grouse stating that shooting was currently exclusively for owners and their families.

Respondents represented their employers in a number of different external forums, most commonly deer management groups (39%) and regional moorland groups (30%), but also on conservation forums (16%). Beyond work, 45% of the respondents also had official roles in their local communities, including: humane dispatch of injured animals; local sports groups; fire services; community business; community councils / associations; rural crime liaison / partnership for wildlife crime.

Employment terms

Head-keepers, beat-keepers and under-keepers were largely employed on a full-time basis (over 90%). Full-time, self-employment numbers were greatest for single-handed keepers and stalkers. Further, 30% of stalkers were self-employed part-time and 17% self-employed full-time, perhaps indicating more contract work being available for deer management. Those working with driven grouse were more likely to be employed on a full-time basis.

Of those in full-time employment as a gamekeeper, stalker or ghillie, 58% earned £15,000 to £25,000, whilst 31% earned £25,000 to £35,000. Although 19% of respondents reported earnings of less than £15,000 per annum from their gamekeeping job, they were invariably not employed full-time in the profession. The gamekeeper respondents provided more than three-quarters of their household income in 43% of cases.

In game and deer management, some employees (and occasionally retirees) resided rent-free in houses on the estate as part of their remuneration package in addition to salary— referred to as ‘tied housing’. In this survey, 60% of the respondents lived in tied housing, whilst 25% resided in their own house and 6% stayed in privately-rented accommodation, which they paid for themselves. Those respondents with driven grouse work were much more likely to stay in tied estate housing (85%) compared to those respondents not engaged in driven grouse work (47%). Of those respondents living in tied housing, 47% had not made any retirement housing plans and employers were expected to provide housing upon retirement for 11%. Fifteen percent of the respondents reported that they had the financial security to buy a house and 27% already owned a house to which they can retire.

With regards to gratuity, 36% of survey respondents stated that they ‘do not receive tips’ at all. For 43% of the respondents, tips made up less than 5% of their income from gamekeeping income whilst 5% received 5-10% of their income from tips and 11% got more than 10% of their income through gratuity.

Over 28% of the respondents were entitled to over 30 days of annual leave, with 50% entitled to 25-29 days and 19% entitled to 20 to 25 days. About two-thirds of the respondents regularly did not fully utilise their annual leave entitlement. Half the respondents said that they were entitled to full pay if they were absent due to illness, but 25% were unsure of their sickness entitlements.

Three quarters of the respondents claimed their employer actively encouraged participation in training courses (56% regular encouragement) but for 20% there was rarely or never encouragement to attend training courses. Whilst 24% felt they would not benefit from training, the most common future types of training that respondents considered beneficial were identified as: habitat impact assessment (33%), access laws (30%), conflict resolution (26%), habitat protection (25%), wildlife monitoring (23%) and wildlife laws (20%).

Crime and abuse

None of the respondents detailed ever having witnessed others in the profession having committed wildlife, or other, crime. However, 37% of the respondents stated that they had witnessed wildlife crime on the ground they had worked on, such as: deer poaching, hare coursing, salmon poaching and disturbance of nesting birds. In addition, 54% of the respondents had witnessed other types of crime on the ground they had worked on, such as: theft and / or deliberate damage of legally-set traps; vandalism; machinery theft; fly-tipping; and unlawful vehicular access.

About 8% of the respondents reported receiving abuse or threats from people outside of their profession on a regular basis (once or twice a month), whilst 56% had experienced such abuse / threats 'rarely' (once or twice per year). Over a third of the respondents had not experienced abuse / threats as a result of their occupation. The majority of abuse received was verbal abuse although incidents of physical violence and online abuse were also reported.

Job satisfaction and outlook

There was a high level of job satisfaction expressed by the respondents, with three-quarters stating that they were 'very satisfied' with their current job (86% of those with driven grouse work and 73% with no driven grouse work were 'very satisfied'). Three-quarters of the respondents also noted that they were generally 'very satisfied' with their relationship with their employer but levels of satisfaction were lowest for job security.

The most important aspect of the working lives of respondents was 'quality of life' (rated 'very important' by 95% of all respondents). 'Ensuring sporting clients are satisfied' and 'making a difference through land management' were also rated 'very important' by over three quarters of respondents, and other factors such as 'the community I live/work in' and 'work colleagues' were very important to over half the respondents. 'Tips' and 'other non-pecuniary benefits' derived from their employment were regarded as the least important aspects of their working life.

Whilst 11% of respondents said that they would change 'nothing' about their job, 39% expressed that they would like to improve public opinion, and media coverage, about the profession. They also made a range of comments about the need for better public understanding of the work they do, and recognition of the benefits that they deliver. There were frustrations that agencies and legislators did not have practical land management backgrounds, meaning that interventions are often considered impracticable or bureaucratic.

Generally, respondents reported that their working lives have become more challenging over the last decade, particularly for those working with driven grouse. Dealing with 'public perceptions of gamekeepers' was rated as the most challenging aspect of working in game and deer management over the past 10 years. Dealing with 'grouse management' (89%), 'wildlife laws' (86%) and 'pest control' (86%) were considered the next most challenging changes faced. 'Owner expectations' and 'client expectations' were considered the aspects of gamekeeping work that have changed the least over the last decade.

Only 6% of respondents were more optimistic about the profession than when they started their career in the sector. Relatively few respondents (10%) stated that their outlook on their profession was unchanged. The outlook for the profession was more pessimistic for 79% of those replying: split between 32% with a 'much less optimistic' outlook and 47% with a 'less optimistic' outlook. The reasons for pessimism felt by some was reported as being related to the perceived negative portrayal of the industry and a perceived lack of support from government and agencies with concerted 'targeting' by anti-shooting campaigns/campaigners and the wider media.

Conclusion - Gamekeeper employment rights

This research provides unique, independently conducted, insights into Scotland's gamekeeping profession. Whilst the responses accounted for a small proportion of the profession, stakeholders on the project's Research Advisory Group considered the results to be a fair representation of the sector. New insights into wage rates, tied housing, and employment terms, as well as sentiments and experiences of being a gamekeeper, were revealed. Key conclusions included:

- Gamekeepers often have strong familial ties to the profession, often perceiving gamekeeping as a 'vocation' or 'way of life' as opposed to a career. Respondents also generally indicated a high level of job satisfaction and a large proportion took great pride in their work, believing that they are working to improve habitats for the betterment of wildlife.
- The employment of around 18% of respondents' partners / spouses on the same estate / business illustrates that there are job opportunities beyond game and deer management on some estates, and this may be important for families living in remote rural glens.
- It is challenging to establish an accurate picture of the overall 'income package' that individual gamekeepers receive – particularly when the nature of employment patterns, wages and other benefits such as tied housing and gratuity differ so widely between individuals. That said, 60% of all respondents and 88% of full-time employees resided in tied housing (rising to 99% of full-time employees who work with driven grouse). If it is assumed conservatively that rented accommodation in these remote areas would cost in the region of £400 per month, it means that the gamekeepers' 'income package' derived from employers is about £5,000 more than their wages, and in some instances these housing benefits extend into retirement. This aspect of the 'income package' appears to be missing from oft-cited income figures used in discourse about gamekeepers and grouse moors.
- Gamekeepers regularly undertook vocational training and qualifications where this was essential for the job and relatively few respondents had no formal training. That said, the respondents offered a wide range of future training needs, with the most prominent being related to habitat and wildlife assessments.
- An underlying frustration was evident among respondents that the gamekeeping profession is much maligned by those who use the countryside for recreation, but do not understand land and game management issues. Many of the respondents reported feeling vilified by mass and social media sources, which can lead to work stresses, incidents of verbal and physical abuse and wilful damage of property. There is a perception that the negative way in which they are portrayed comes from a lack of understanding of the roles that gamekeepers play. There was also an undercurrent of resentment that government and agencies 'do not engage' more with the sector's knowledge base to work out practical solutions for mutual benefits.
- It was regularly expressed that those in the profession possess extensive practical knowledge regarding game, deer and wildlife management. For

many, there was a desire to have more open, public dialogue about practical land management options that can lead to greater consensus, rather than conflict. A number suggested that more needed to be done to educate the general public about the profession, enabling them to develop 'more informed opinions'.

7. Part 3- Mapping the areas and management intensity of moorland actively managed for grouse

Background

The 'Phase 2' research updates and enhances the work reported by Matthews *et al.* (2018) in [Phase 1](#), where geographical information system (GIS) and remote sensing methods were used to identify areas of driven grouse moors and assess their potential for alternative land uses. As part of the Phase 1 analysis, assessments were also made of the intensity of moorland management. An assessment of grouse butt density (number per km²) was made for the first time, but the assessment of strip burning of heather relied on data from 2005-11. This meant that the Phase 1 analysis could provide no insights into changes in strip burning of heather that have occurred in the last decade. The [Phase 2 analysis](#) has addressed this limitation by providing updated (to June 2018) and higher resolution mapping of strip burning. The characterisation of grouse butt density was also enhanced by making an improved assessment of the areas of rough grazing that are close to the locations of grouse butts. This section provides a summary of the [full technical report for Part 3](#).

Improvements to the available data and methods

The project has collected new data for all agricultural holdings identified in Phase 1 as having grouse butts present and rough grazing, by undertaking the following six steps:

1. Updating the mapping of strip burning from 2005-11 to June 2018 – interpreting aerial photography or high-resolution satellite data.
2. Adding a “burned since” date by comparing 2018 with earlier imagery to quantify the likelihood that strip burning of heather moorland continues to be active rather than being a relict feature.
3. Improving the spatial resolution of strip burning analysis from a 1km to a 200m grid allowing the attribution of areas of burning to specific holdings. This attribution means it is now possible for the first time to look at the distribution of burning areas and intensity across all land holdings.
4. Identifying where there may have been a change in intensity of burning by comparing 2018 data with that from the 2005-11 analysis. Any comparison needs to be made carefully given the differences in the methods and data used but indicative conclusions can be drawn.
5. Defining areas more likely to be subjected to management for driven grouse, by identifying rough grazing within set distances of grouse butts (500m to 2,000m) as being those more likely to be subjected to some form of

management for driven grouse. This gives a more robust estimation of the area of driven grouse management with quantified levels of uncertainty. This method eliminates from consideration large areas of rough grazing in holdings that are remote from grouse butts and had in the Phase 1 analysis inflated the overall area associated with driven grouse moors and underestimated the intensity of management being practiced.

6. Improving the estimation of grouse butt density (butts per km²) using data from (5) above) as another indicator of intensity of management.

Taken together the six steps enable the creation of a single unified dataset integrating land cover/use, area and intensity of burning, grouse butt numbers and their density and the other characterisation data taken from the Phase 1 analysis. From this dataset, deductions about the number and characteristics of holdings, engaged in driven grouse moor management can be made.

Caveats to the analysis

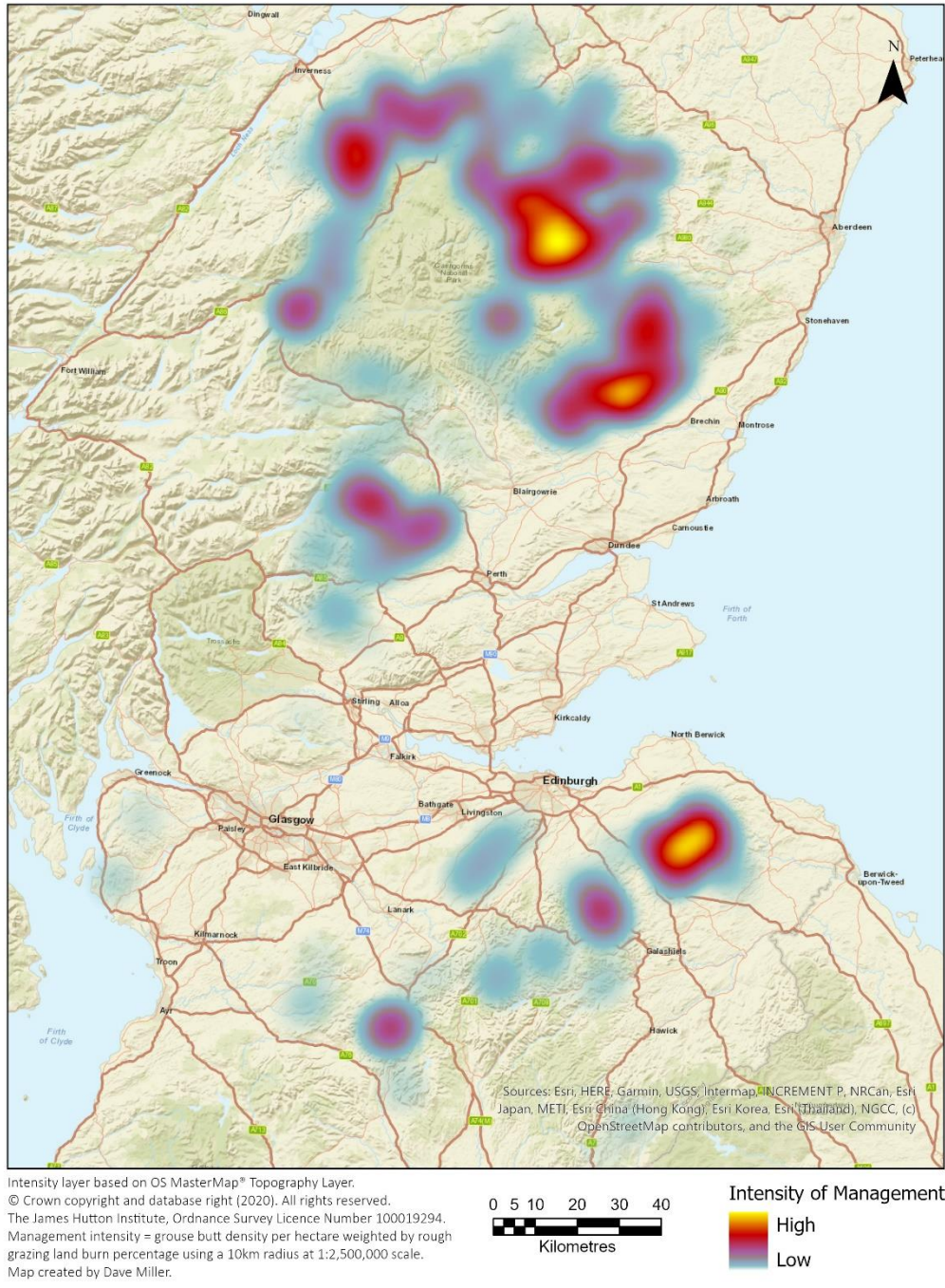
While the analysis conducted has improved on the Phase 1 and earlier analyses, there are still limitations. Specifically, it was not possible to reinterpret all the potential areas in Scotland where burning could be occurring. Reinterpretation was therefore prioritised in locations where burning was present in both of the previous burning studies by RSPB (Douglas *et al.*, 2015) and James Hutton Institute (McLeod and Newey, 2018). For the areas present in only one of these studies, another supplementary strip-burning analysis project was undertaken funded by the Scottish Government's Strategic Research Programme (SRP) 2016-22, starting in January 2020 and completed in March 2020. Digital datasets are supplied to the Scottish Government.

Summary Map

The map in Figure 1 provides a high-level summary of the analysis of driven grouse moor management within the project. The figure uses a heat map to show the locations, area and intensity of management, in terms of both grouse butt density and percentage of rough grazing area being burned. The heat map highlights relative intensity of grouse moorland management - from low intensity blues to highest intensity yellows. Since the heat map summarises characteristics within a 10km radius circle, it provides a form of landscape level summary that is helpful in emphasising where there are concentrations of activity within Scotland - in this case highlighting the Cairngorms, Angus Glens and the Lammermuir Hills. The map can also be interpreted as showing the degree of certainty that an area had driven grouse moor management present, with the lower intensity areas potentially no longer being actively managed for driven grouse.

Figure 1: Heat map summary of locations, areas and intensity of driven grouse moor management

Density of Grouse Butts Weighted by Burn Percentage



Mapping areas and management intensity - key findings

The total land area on the 491 holdings with grouse butts mapped on rough grazing was about 1 million hectares. Of the total area, 858,000 hectares were rough grazing with 584,000 hectares (68%) falling within 2 kilometres of grouse butts and 388,000 hectares (45%) within 1 kilometre. A substantial share of this rough grazing land (187,000 ha or 32% of the rough grazing within 2 kilometres of butts) was managed by 13 holdings, each with more than 10,000 hectares of rough

grazing. The burned area of rough grazing for the 491 holdings was 163,000 hectares.

Active burning in 2018 was confirmed present on 79% of the holdings and 87% of area, and no active strip burning was found for only 11% of holdings and on 7% of the area. For the holdings without burning, the grouse butts present are likely remaining as a relict feature of previous land management. Where burning was identified as present, this was confirmed as having occurred typically after 2013 and in some cases since 2015, with smaller areas relying on older data.

There were changes in the intensity of management between the period of the RSPB analysis (2005-11) and 2018, with both increases and decreases in intensity apparent with regional variations and clusters of change. There is, though, a need to be cautious in interpreting local patterns due to differences in data and interpretation methods. Any definitive interpretation of change would require a more detailed analysis of individual holdings data.

Areas closer to grouse butts were being burned more intensively (i.e. they have higher ratios of burned to rough grazing area). Any estimation of intensity needs to be explicit on the assumptions about which areas of rough grazing within land holdings were included in the driven grouse moor area. For example, if the whole area of rough grazed land present in the holdings is used, then the burned percentage is 19%. If only the rough grazing within 2,000m of the grouse butts is used then the burned percentage increases to 25% and within 500m the burned percentage is 38%.

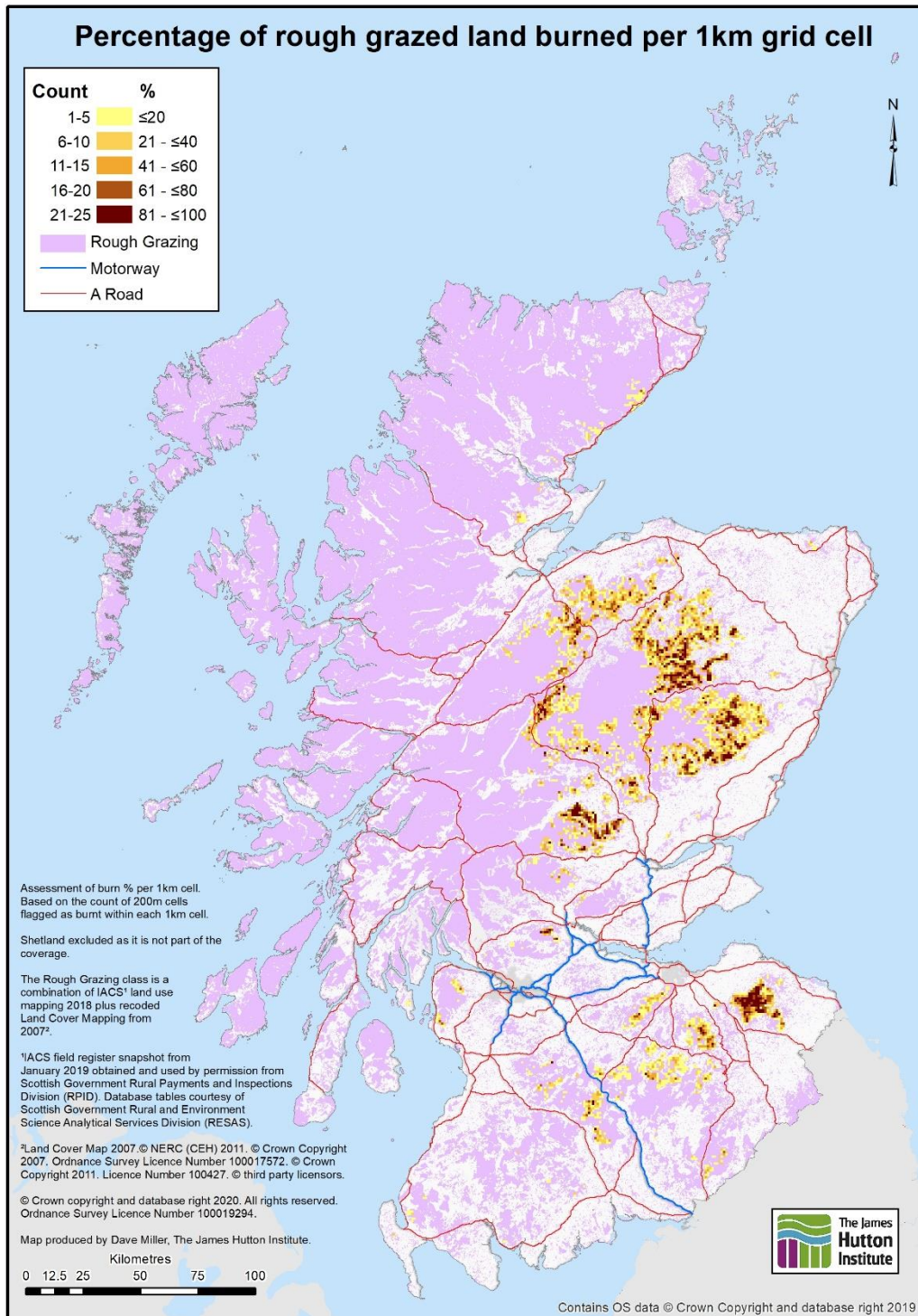
The distribution of burned percentages across holdings was biased towards lower intensities which may suggest that some of the holdings were largely inactive in terms of driven grouse. The holdings with higher grouse management intensity (those above 50% burned), though, made up 11% of the population and had burning intensity values more than twice, and up to four times, the median burn percentage of 19%. The holdings with more than 60% burned had about 34,000 hectares (22%) of the burned area on 35 holdings, for an average per holding burned area of about 960 hectares. Figure 2 illustrates the distribution of high strip burning intensity.

The grouse butt density values had a wide range of values from less than one per square kilometre to over 10 per square kilometre (and in rare cases considerably higher). The range of densities reflected the wide variety of ways in which driven grouse management can take place. There was a bias in the distribution towards lower grouse butt densities but there were 28 holdings with grouse butt densities over 10 per square kilometre and these were collectively managing a total of around 15,000 hectares of land. Were environmental harm being generated mainly on holdings with higher densities of grouse butts, then implementation of any monitoring regime could be simplified by prioritising the relatively small numbers of such holdings.

The threshold above which the density of grouse butts might be considered excessive will depend on the circumstances in which it occurs and how the butts

are used. It is likely that there can be a range of management practices associated with holdings having broadly the same density of butts per hectare. Therefore, the utility of the analysis would seem to be in highlighting cases where it might be prudent to work with holding owners to ensure that any negative impacts can be minimised.

Figure 2: Map of percentage of rough grazing land burned per 1km map grid cell



Confirming Phase 1 analysis

The findings from this research, while having updated and substantially improved on the analysis that was possible in Phase 1, are consistent with the findings of the earlier GIS-based analysis by Matthews *et al.* (2018) in [Phase 1 of this project](#). Specifically, the analysis reconfirms the diversity of ways in which driven grouse moor management can be conducted. Within holdings, a grouse moor can, in area terms, be a dominant enterprise or near insignificant. In terms of intensity of management, grouse moors are highly variable with large differences even between neighbouring holdings. Overall, the land used for driven grouse has very limited potential for production-oriented agriculture and forestry enterprises, though other uses that do not rely on the biophysical productivity of the land may be viable. [Part 1](#) of this Phase 2 project further considered alternative moorland uses.

Opportunities for further research and stakeholder engagement

The new datasets created within this research can serve as a baseline against which to assess future change in key aspects of driven grouse moor management. The data also has potential value as a training dataset for any computer-based methods being developed to monitor the extent and intensity of moorland strip burning in Scotland. There are several ways in which the analysis could be improved but to move beyond incremental improvements would rely on gaining access to privately held data on land management practices. This could be gained through co-operation with stakeholder and industry associations and/or by augmenting existing Scottish Government data gathering processes such as the June Census/December Survey or the Single Application Form.

8. Part 4- Biodiversity considerations on grouse moors

[Part 4](#) of the [Phase 2 research](#) examined the biodiversity impacts of driven grouse moors using species distribution data for selected moorland biodiversity indicator species. This work utilised estimates of moorland management intensity for driven grouse developed in [Part 3](#) of the Phase 2 research - GIS mapping of the management and intensity of grouse moors.)

Grouse moor management comprises of a range of management practices, including predator control, muirburn, grazing management and disease management. The Phase 1 research ([Brooker et al.](#), 2018b) amongst others (Thompson *et al.*, 2016; Mustin *et al.*, 2018), reported that grouse moor management has been demonstrated to have positive and negative effects on the distribution and abundance of different species and biodiversity. Predator control, the legal killing of crows, foxes, stoats and weasels undertaken as part of grouse moor management to minimise predation of red grouse, has been shown to benefit other ground nesting birds and is thought to benefit mountain hares. Whilst predator control will suppress the local population of controlled species, the Phase 1 research highlighted that the wider biodiversity impacts of predator control on the controlled species are poorly understood.

Overall, the effects of grouse moor management practices vary with habitat (e.g. wet or dry heath), species and management type, and in many cases the evidence base is not conclusive on whether specific practices have positive or negative biodiversity effects (Thompson *et al.*, 2016; Brooker *et al.*, 2018b; Mustin *et al.*, 2018; GMMG, 2019). While there is a clear evidence base that grouse moor management can positively and/or negatively affect different species of wading birds, raptors, and vegetation communities, the evidence remains inconclusive for many other taxonomic groups and species (Brooker *et al.*, 2018b; Mustin *et al.*, 2018). Indeed, the effects of grouse moor management on the distribution and abundance of the majority of species has not been investigated. This section provides a summary of the [full technical report for Part 4](#).

Method

Within [Part 4](#) of the Phase 2 research, the effect of grouse moor management, based on the intensity of muirburn (the estimated percentage of ground burnt), on the distribution of selected upland species was assessed. The species used in this study were chosen through consultation with the project Research Advisory Group and Scottish Government to reflect a small selection of species that are likely to be negatively or positively affected by grouse moor management, and for which there was suitable occurrence data available for analyses within the time frame and resources available. Some obvious species of interest such as mountain hare *Lepus timidus*, red deer *Cervus elaphus*, and high conservation priority species such as lapwing *Vanellus*, were not included in the final list of species assessed because there is already a substantial body of evidence indicating that these

species benefit from and are positively associated with moorland managed for grouse shooting (Fletcher *et al.*, 2010; Patton *et al.*, 2010; Newey *et al.*, 2016; Mustin *et al.*, 2018; Littlewood *et al.*, 2019). Rather, the aim of this work was to assess the effects of the intensity of grouse moor management on species where the association between species distribution and grouse moor management is less well understood or unknown. The species selected for review were:

- Birch
- Green hairstreak butterfly
- Curlew
- Merlin
- Lesser redpoll
- Bilberry / blaeberry
- Adder
- Golden plover
- Kestrel
- Whinchat

Using outputs from [Part 3 of this research](#) (Matthews *et al.*, 2020) estimates of management intensity were based on the extent of muirburn at the 1 km square scale. To estimate management intensity, the number of 200 m x 200 m cells within each 1 km square (25 assessed squares) that were classified as at least 50% burnt were summed and converted to a percentage. This estimate of percentage muirburn assumed that each cell classified as burnt was 100% burnt, which is not necessarily true since the percentage of burn for each cell will range from 51-100% and is therefore an overestimate of actual muirburn. However, it was considered that this likely provided a good estimate of the intensity of management and area of land under grouse moor management.

To assess the distribution of the chosen species in relation to muirburn intensity, the species distribution and muirburn intensity data were overlaid. For those biodiversity species where the distribution data was only available at the 10 x 10 km² (hectad) scale, the percentage burn at the 1 km square level was calculated and the median value of the 1 km squares within that 100 km square was used to represent the overall level of muirburn. Twelve percent of 1 km squares assessed were classed as been less than 5% burnt, and 60% of squares were classified as less than 41% burnt.

With all species data care is needed in interpreting the relationship between species occurrence and the high levels of muirburn, as the sample size of both the number of assessed squares within each burn category, and the number of species records are low for these high intensity burn categories. In addition, it must be noted that assessment was restricted to the area for which muirburn data was available and that this was largely from areas where grouse moor management was known to be an important land use. The restricted area also had the consequence of reducing the area of intersection between areas assessed for muirburn and species occurrence data.

Biodiversity considerations - key findings

Using aerial photography or satellite imagery for 3,616 1km squares classified as burnt, and the approach to estimating burning intensity outlined above, it was

estimated that the proportion of the area classed in different muirburn intensities were:

<u>Muirburn intensity</u>	<u>Proportion of assessed area</u>
• less than 5% burnt	• 12% of the area
• 6-20% burnt	• 24% of the area
• 21-40% burnt	• 24% of the area
• 41-60% burnt	• 18% of the area
• 61-80% burnt	• 13% of the area
• 81-100% burnt	• 11% of the area

The key results from the Part 4 assessment of biodiversity results included:

- **Birch and blaeberry** were most prevalent in areas with little or intermediate levels of burning and showed a decline with increasing burning but were also present in squares with high levels of muirburn.
- **Green hairstreak butterfly and adder** were both most prevalent at low to moderate levels of burning and showed a general decline in prevalence with very high levels of burning. However, the pattern in change in prevalence with increasing burning is not clear. For these 'semi-cryptic' species it was not clear whether apparent greater prevalence in intensely burnt areas reflects greater detectability in these areas or greater abundances.
- **Curlew and golden plover** prevalence generally increased with intensity of muirburn, though golden plover occurrence peaked in the 41-60% burn category, whereas curlew increased with greater percentage muirburn. This was particularly the case for these, and the other bird species assessed at the hectad (10 x 10 km) scale where sample sizes for squares representing intense muirburn were very small.
- **Merlin** prevalence increased with increasing intensity of muirburn up to the 41-60% muirburn, and then declined and was absent from the squares with 81-100% burning, whereas kestrel was present at a consistent level across all muirburn categories up to 81%. Interpretation of prevalence at the 81% plus muirburn category is likely confounded by small sample size.
- Both **lesser redpoll and whinchat** showed consistent levels of prevalence at low to moderate levels of muirburn and showed increases in prevalence in the 61% and higher muirburn categories. Lesser redpoll prevalence peaked in the 61-80% burn category and the species was absent in the 81-100% category, while whinchat was most prevalent in the 81-100% category.

Conclusions - biodiversity

The occurrence of ten species was assessed in relation to intensity of muirburn in areas of Scotland where grouse moor management is an important land use. Overall, it proved challenging to identify clear patterns in the occurrence of these species relative to intensity of muirburn.

It is difficult to draw any firm conclusions and for all species care is needed in interpreting the relationship between species occurrence and the high levels of muirburn as the sample size of both the number of assessed squares within each burn category, and the number of species records are low for these high intensity burn categories. Species may be responding to aspects of moorland management other than muirburn and for the bird species occurrence was likely influenced by the wider landscape.

Birch was the only species assessed where prevalence appeared to decline with increasing intensity of muirburn, though blaeberry also showed evidence of lower prevalence at the highest category of muirburn. Green hairstreak butterfly, adder, and kestrel showed fairly consistent occurrence across the range of muirburn measured. Golden plover and merlin showed an increased occurrence with greater burning, occurrence for these species peaked at intermediate levels of muirburn. Curlew, whinchat and lesser redpoll appeared to increase in prevalence with increasing percentage of ground classed as burnt.

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