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Understanding the experiences of peatland restoration in Scotland

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1 Executive summary

1.1 Aims and background

Scotland is a global pioneer of peatland restoration which is widely seen as having a significant role in addressing the global climate emergency.

Peatlands cover nearly a quarter of Scotland and contain over half of the total Scottish soil carbon. However, a high proportion of Scottish peatlands has been altered to such an extent that it is now degraded, causing substantial greenhouse gas (GHG) emissions. Consequently, the Scottish Government has established ambitious peatland restoration targets; a large funding programme – Peatland Action – has been in place since 2012, complementing work by other delivery partners such as Scottish Water and Forestry and Land Scotland.

While there is evident potential for peatland restoration to provide climate and wider ecosystem benefits, much less is known about the broader perceptions of peatlands, and the values attached to their restoration.

This report examines current experiences of peatland restoration, as well as the anticipated outcomes and factors influencing engagement with restoration. We also consider the opportunities and challenges for upscaling restoration efforts going forward. This information can help guide the administration of public support for peatland restoration as it evolves and increases in prominence.

1.2 Findings

- **Land managers are motivated to restore peatland by the multiple benefits that it generates.**
  Some of the most frequently observed benefits are: changes to the hydrology, prevention of further peat erosion (and retention of existing carbon stores) and habitat and landscape improvement. This, in turn, can result in: flood risk

reduction, lower water treatment costs, and improved ability of local communities to engage with peatlands.

- **Early engagement with landowners and communities facilitates participation in restoration, as does funding of up-front costs.** Organising talks, walks and early consultation events helps to explain benefits, raise awareness and address negative perceptions. Conducting feasibility studies and embedding Peatland Action (PA) officers in local organisations also facilitates participation.
- **The main barriers to engagement relate to the wider impacts on how land is managed and a lack of knowledge or understanding. We also found evidence of 'cultural' clashes.** Concerns were expressed regarding the impact of restoration on farming activities and eligibility for agricultural payments or governmental tax breaks. Lack of knowledge or understanding was mentioned in relation to the support available and the application and funding process, and to the benefits of peatland restoration. Peatland restoration is seen by some as undermining cultural and historical values.
- **Challenges during restoration activities are closely tied to environmental challenges, as well as problems of communication and coordination.** Environmental challenges can result in general logistical problems during restoration. Communication issues among different actors can also lead to problems during restoration.

1.3 Conclusions

- **Improved communication might encourage uptake by a more diverse range of land managers.** This includes clearer information on what support is available in terms of preparing applications, carrying out restoration and managing the projects.
- **There are clear benefits in facilitating connections across stakeholders.** This can be done by embedding PA officers (or other knowledge brokers / facilitators) in organisations and also by promoting partnership working.
- **Funding of up-front restoration costs is effective. There may be value in supporting maintenance /management costs and cross-overs with farm payments.** All these aspects were considered very important to encourage other land owners to engage in peatland restoration.
- **Training and resources** are important to ensure works are carried out to satisfactory standards even in the most challenging locations.
- **Pooling or shared hire systems of specialist equipment** might improve physical provision and alleviate concerns from a number of potential participants.

Our main findings on the strengths, weaknesses, opportunities and threats are captured in the table below.

Peatland restoration in Scotland : strengths, weaknesses, opportunities and threats

Strengths	Weaknesses
• Delivers multiple environmental and social benefits (carbon, biodiversity, water regulation, employment, etc.). • Demonstrates good land stewardship. • Improves public perception of farming. • Provides opportunities for peer-to-peer learning. • Early engagement with landowners facilitates restoration. • Embedding PA officers in other organisations facilitates building-up connections and engagement. • Funding of up-front costs.	• Wider impacts on perceptions of how land is managed. • Impact on eligibility for farming payments or government tax breaks. • Temporary cashflow problems. • Tight timings to deliver the project over winter months. • Cultural clashes from loss of historical and cultural values. • Potential negative public perceptions of tree removals. • Ease of restoration logistics contingent on environmental conditions.

Opportunities	Threats
• Wider promotion of benefits from restoration and support. • Target promotion efforts and engagement with smaller landowners, such as crofters. • Neighbours can help the spread of peatland restoration with peer-to-peer learning on the experience of restoration. • Conduct systematic monitoring of restoration impacts. • Recognise historical good practice in land (peatland) management. • Consider farm and land-based cycles for funding scheduling. • Develop a pooling or shared hire system of specialist equipment. • Include training in the use of specialist equipment. • Include peatland maintenance/management in future agri-environmental schemes.	**To uptake:** • Complexity of application process and funding mechanism. • Lack of knowledge of the benefits, or the process, of restoration. • Differing views on what is considered ‘degraded peatland’. **To outcomes:** • Not being able to secure multi-year funding for significant restoration efforts. • Inconsistency in guidance regarding use of peatlands. • Poor communication between different partners (e.g. contractors, land managers, estate factors, PA officer, etc.). • Partnerships can bring clashes between visions and objectives.

Contents

2 Introduction

2.1 Aims and objectives

This research focuses on current experiences of peatland restoration in Scotland. The report has two key aims:

- To synthesise current experiences and barriers to engage with peatland restoration.
- To identify the lessons learned and how they can inform the design and management of future investments in peatland restoration.

2.2 Background

The UK's blanket bogs – areas of peatland - are the largest terrestrial carbon store in the UK[1,2] and represent 10%–15% of their total global extent[3] with an area of approximately 1.5 million ha[4]. Most blanket bogs – and thus most of the UK's terrestrial carbon stores – are located in Scotland. Decades of drainage and subsequent land use have resulted in large parts of the Scottish blanket bog being damaged to varying degrees[5]. As opposed to near natural blanket bogs that act as small carbon sinks, drained and damaged blanket bogs emit substantial amounts of greenhouse gases (GHGs), contributing to climate change. Emissions could be reduced, and modest removals of GHGs achieved, if damaged peatlands were restored, mainly through raising the water table and facilitating the establishment of peatland vegetation.

Peatland restoration has increasingly received attention by policy-makers across the UK, Europe and globally as a cost-effective way to contribute to achieving policy targets regarding climate change and biodiversity[6,7]. This is primarily due to its potential to reduce GHG emissions, but also to expected benefits regarding the regulation of water quantity and quality, and biodiversity.

Globally, Scotland is a pioneer of peatland restoration. Since 2012, peatland restoration has been carried out on more than 25,000 hectares. This has been mainly via the Peatland Action (PA) programme supported by the Scottish Government and administered by NatureScot. In February 2020, the Scottish Government announced an increase in investment in peatland restoration of more than £250 million over the next 10 years.

The evidence for the potential carbon and wider ecosystem benefits is clear. However, much less is known about how peatlands – and their restoration – are perceived and valued. Previous research has shown the existence of conflicting perceptions of the benefits they provide, which is seen as a potential barrier for scaling up peatland restoration[8]. This work also identifies complex attitudes regarding restoration of peatlands in the crofting community on the Isle of Lewis. For example, some of the participants in peat-rich areas saw peatland restoration as something imposed from the outside, questioning local realities and values, and part of a more general marginalisation of rural identities and ways of life. Further research on people's engagement with peatlands and peatland restoration in Scotland highlighted the importance of personal experiences, relationships and learning in fostering care for peatlands[9]. A 2017 evidence review of the wider impacts of climate change mitigation measures points to clear evidence gaps regarding impacts on income, supply and demand of food and timber, employment in rural areas, as well as social and cultural impacts[10].

There is thus a need for a better characterisation of the outcomes and wider impacts of restoration activity to date, and an indication of opportunities and challenges going forward as peatland restoration increases in prominence.

2.3 Method and approach

The research draws on the following two main data sources and relies largely on qualitative data analysis:

1. Final reports provided by PA recipients. We analysed a subset of recipients that formed the basis of an earlier analysis on restoration costs[11] comprising 46 (out of 90) of the final report forms. These include projects that took place between 2016 and 2019. Appendix A includes a blank final report template used in 2017-2018 for reference[1].
2. Five semi-structured interviews, conducted remotely, with key stakeholders who provided a wider perspective on the experiences and challenges of peatland restoration[2].

Appendix B includes further details on the data and analysis. Appendix C includes the codebook used for the qualitative coding of the PA forms and interviews.

As with any study, there are limitations:

- The research does not provide a full account of different experiences of peatland restoration as it considers mainly those gained through the Peatland Action programme.
- The analysis only includes a sub-set of projects and focuses on the information directly stated in the final reporting forms. Hence, it is not exploring other aspects that may exist but which have not been expressed in the forms.
- There is limited data on those who dropped out of peatland restoration or did not engage with it. The interviews aimed to fill some of these gaps.

3 Motivations to engage in peatland restoration

Behind the actual implementation of a project, there are several possible reasons which motivate land managers to engage with peatland restoration. Motivations span the environmental and socioeconomic domains; this section explores them based on replies provided in Peatland Action's final reports and in the interviews. This is done by (1) assessing the most recurring motivations and (2) exploring how the general theme of restoration goals intersects with other dimensions of interest.

These goals may be overlapping – especially because they may happen to be instrumental to each other. This could be the case, for instance, in reducing erosion for aesthetic improvement and providing a safer site for livestock.

[1] Forms for current funding round (2021-2022) can be found here: https://www.nature.scot/peatland-action-application-form-guidance-applicants-and-standard-terms-and-conditions-funding

[2] See Table B1 for interview participant affiliations.

3.1 General assessment of motivations and restoration goals

Among the most frequent reasons cited in the PA forms and interviews for engaging in peatland restoration, those that stand out relate to:

- Carbon management
- Improving conditions for biodiversity (both animal and plant)
- Regulating the water flow / hydrology
- Improving and protecting water quality

Often stated, although less frequently than the previous reasons, are restoration goals regarding the intention to:

- Improve conditions for stock management
- Recover vegetation
- Generally reduce erosion
- Contribute to wider scale benefits of restoration
- Contribute to an aesthetical improvement of the landscape

Among the sporadic reasons, the following can be noted:

- Providing better access to the site
- Recovering from impacts of previous grazing
- A general sense of responsibility towards a specific condition of the natural environment
- Balancing the needs of farming and conservation
- Experiencing social benefits during the act of restoration, especially focusing on local peatland communities
- Reducing the impact of peatland degradation on existing human-made infrastructure (e.g. runoff from a peatland site damaging nearby road)

In addition, interviewees spoke about land managers collectively rather than as individual cases, for example, being motivated to 'do the right thing' as a good steward of the land and improving the image and public perception of farming.

Applicants to Peatland Action's funding were also asked to rate 14 pre-identified reasons as "Very important", "Somewhat important" and "Not important at all" for engaging in peatland restoration. The following reasons received the highest ratings: **improving conditions for biodiversity**, **reducing carbon footprint** and **improving quality of water**. Further details are included in Appendix D.

In terms of the least popular motivations, we found the reduced need for controlled burning, the potential access to carbon markets, reducing the mortality of livestock and improving access to land. In particular, the relatively low score of carbon markets compared to the relatively high score of carbon footprint reduction is in line with what was noted from the interviews, namely the importance of normative reasons (i.e. 'doing the right thing') to engage in restoration. Appendix E provides further details.

3.2 Understanding restoration goals

In our initial analysis, we identified some overlaps between factors related to the 'History of the site', 'Current management and issue', and 'Scale of restoration' and how the specific restoration goals are framed by an applicant in the PA forms. Table *1* summarises the occurrence of the overlaps; the sub-sections that follow explain them in further detail.

Table 1: Overlap between ‘Restoration goals’ and other relevant factors

Themes	Overlaps with ‘Restoration goals’
Current management and use	5
History of the site	4
Scale of restoration	5

3.2.1 Current management and use

Some applicants are motivated by existing management issues. For example:

- The intention to recover a site from a failed effort of commercial forestry
- The interplay between the condition of peatland and the areas where cattle and sheep currently graze
- The intention to use a specific site for light summer grazing, making it safer for animals and allowing for access
- The site being part of a large management group and, as such, contributing to landscape-level management efforts

Overall, this shows there are several issues for which peatland restoration may present a positive choice. This point can be illustrated by drawing on the examples above, i.e. taking a single activity, namely grazing, and showing how it may relate to restoration in different ways.

In some cases, restoration can address land management issues perceived as negative, such as ecological damage from human-related activities, such as over-grazing. In other cases, however, restoration acts as a means to support proactive positive change. For instance, peatland restoration might be desirable not only *per se* but also instrumentally to support sustainable grazing in the area by making the site safer for the purpose.

3.2.2 History of the site

There is a similar interaction between ‘History of the site’ and ‘Restoration goals’, with the difference that, in this case, peatland restoration has a more intentional role to recover from historic and less-immediate negative impacts.

These come, for example, from:

- Forest management practices that were the standard in the 20th century but that are viewed as not sustainable today
- Long-term effects of past grazing in the area
- Land-cover outcomes of tax incentives towards conifers planting in the 1970s and 1980s

In these cases, restoration appears to be more akin to a means to deal with the legacies of distant visions of land use.

3.2.3 Scale

Scale – in terms of land management unit – is a significant issue affecting motivations:

- In terms of the initial motivation, interviewees suggested that large-scale landowners are more capable of doing so – as opposed to small-scale landowners – because they are more likely to have additional staff resource, are able to think and plan further ahead, and are likely to speak with consultants.
- There is a sense that the Government prefers to allocate money to larger-scale projects because that makes it easier to reach spending targets.
- At the same time, one interviewee suggested the possibility that communication efforts focused on the wider public domain associate the idea of peatland restoration to big estates, and that a language adjustment might help to change this trend.
- Finally, one interviewee noted that, given that small landowners may struggle to carry out substantial restoration efforts on their own, it is important to have regional land-use partnerships coming together to help achieve significant landscape goals.

This last point links to what was found in PA forms – more specifically, about the restoration goals and issues of scale: instances emerged where restoration on a specific site is actually motivated by a wider restoration plan (e.g. "*The work […] is part of one of the most ambitious collaborative peatland restoration projects in Scotland, which aims to deliver 4,500ha of restoration over 5 years across a total of 14 estates*" or "*The primary objective […] is to restore the full range of peatland communities and condition across the whole area, some 1,719 hectares*" (*PA form*)). We also found one case where the ambitious scale of a restoration project was specifically driven and justified by a diverse partnership, including the private, public and NGO sectors, where both farming and conservation interests converged.

However, in some cases the larger scale of a project may raise concerns in terms of resources and/or logistics and result in more modest restoration goals in order to ensure their success ("*[…] These goals were by necessity kept simple due to the operators never having carried out work such as this over such a large area*" *(PA form)*).

3.3 Barriers to engagement with peatland restoration

Information on barriers to engagement was not sought in the PA forms, and so the results here are based only on the interview data.

Several interviewees commented that they thought there were no major barriers to uptake of peatland restoration initiatives; however, all went on to cite examples. Those who commented in more detail on barriers were connected to smaller-scale operators such as crofters and farmers. The main barriers identified across all of the interviews were:

- Concerns about wider impacts on how land was managed
- Challenges with understanding or dealing with the application process and funding mechanism
- Knowledge of the benefits, or the process, of restoration
- Cultural conflicts, including reversal of past peatland management practices, and economies of scale

3.3.1 Land management

In terms of impacts on wider land management, it was noted that changing the use of peatland may mean other thresholds were exceeded:

> *"[landowners may say] 'if I if I take this big chunk of land out ... I will have to reduce the number of sheep I have. I then won't have enough to justify [a] shepherd', so you know it has all these knock-on effects on the rest of the estate" (I1.1)*[3]

A similar level of concern was noted around the impact that restoration may have on eligibility for payments such as Pillar 1 CAP payments or government tax breaks and re-classification of peatlands from/to 'agricultural land' (I3). It was conceded that such issues may change with post-Brexit agricultural policies.

> *"certainly in recent years, there's been confusion about the eligibility of restored peatlands for support under pillar one of the [Common Agricultural] Policy so that the basic payment scheme only pays out on land that is actually regarded as agricultural" (I3)*

3.3.2 Peatland condition

Differing views on what was considered 'degraded peatland' were also identified as barriers to land owners thinking that restoration would be necessary or appropriate on their land. It was suggested that an improvement in communication around what constitutes degraded could help encourage land owners/managers to be more pro-active in applying for support to restore:

> *"... people think 'our peatland is okay' because ... you can't stand in a ditch and it's above your head, like you see pictures of the Flow Country and stuff. It's not like that. It's lots of little bits of exposed peat and because a lot of it can be wind damage as well as, not necessarily human damage, people struggle to think that their moorland isn't great. OK, like they think 'our peatland's fine', so why would we need to restore it? … So I think there's a lack of understanding of what needs restored - it's a definite issue."* (I4)

3.3.3 Knowledge

A lack of knowledge or understanding was mentioned within a range of contexts – this may be related to several factors, including lack of knowledge (or clarity) about the support available or the application and funding process, the need for restoration or about the benefits of peatland restoration. A communication issue was offered as the cause of some resistance to uptake in that it can be unclear to land managers what support is available in terms of preparing applications, carrying out restoration and managing the projects (I3).

> *"You can address some of these things locally. I mean, you know, like the communication and the clarity of eligibility for ongoing support." (I3)*

Lack of in-depth understanding of the funding mechanism and the time required to learn the process and requirements was attested as one of the primary factors in low uptake from farmers and crofters. When considered within the context of long working days and substantial stresses faced in the farming industry, the challenge of digesting and acting upon seemingly complex political processes was considered inhibiting.

[3] See Table A1 for interview participant affiliations

“They [farmers and crofters] […] but they don't necessarily have like the time, and then it's daunting. And there is that whole kind of difficulty with knowledge transfer across the industry. And people learn in different ways and people you know are disproportionately affected by dyslexia within agriculture. And so there are all these kind of you know, I guess, social barriers to taking this up.” (I5)

“...if things are difficult to apply for or the difficult to access, then people aren't going to do it” (I5)

“For example, getting up at 3:00 o'clock in the morning to milk cows or spending 12 hours a day outside in the rain, especially from the West Coast, and so ... if things are difficult to apply for or really lengthy people aren't going to engage. And then it's the same with any kind of promotional material. Educational material people aren't going to engage with it. If it's screens and screens of information, and I think that's a huge barrier” (I5)

3.3.4 Guidance

Inconsistency in guidance over time was also flagged; the drive to restore peatlands was highlighted as contradictory to the guidance that land managers received in previous decades, which was to drain peatland areas. A degree of cynicism about the value or longevity of the current government’s encouragement to restore peatlands can be attributed to the changes in guidance over the last 30 years or so. Related to this was a reluctance to essentially undo some of the large-scale land management that had been carried out by predecessors. This seemed to be influential either in their perception of ‘betrayal’ to family lines or to the wider community.

“Because crofters say ‘Oh yeah, this is another government big idea so you know 20 years ago they paid us to drain the bogs and now they're paying us to flood the bogs and you know, wait awhile, and maybe they'll tell us to drain them again’.” (I2)

“Sometimes that's [reluctance to restore] expressed in terms of, you know, honouring my ancestors, you know, I'm the fifth-generation farmer here. My ancestors have put a lot of effort into raising the agricultural potential of this land, it's up to me to maintain that tradition. And some of that is bound up with actual agricultural productivity. Some of it is bound up with the landscape and a lot of it is around culture.” (I3)

3.3.5 Cultural values

Peatland has cultural and historical values attributed to it, particularly in the process of peat cutting (for use of the dried peat as fuel). This practice shapes the landscape and is often an important community exercise. Restoration is seen as something which will end this practice and so land owners can become protective of it:

“So our biggest challenge here in terms of peatland restoration is peat cutting. So peat cutting has now quit, it's not widespread here anymore, but it was widespread. But there's a lot of heritage involved in it. It's quite an important part of the landscape” (I4)

3.3.6 Communication

The materials and approach to communication on the Peatland Action was mentioned by several interviewees as something which may be inhibitory or dissuasive to smaller scale land managers. It was noted (I1.2) that the focus in the public domain had been on big estates and that perhaps a language change was needed to encourage uptake by a more diverse range of land managers. Additionally, two interviewees (I2 and I5) observed that it seems easier for large-scale land managers to achieve the 'points' needed to obtain funds from government, for example, because of larger numbers of people working with/for them, more extensive networks, and greater opportunities to engage consultants to assist with applications. In the context of crofters, it was noted that Common Grazing can collectively account for around 500,000 hectares of land and so some facilitation of the land managers engaged with this would allow greater uptake by crofters as a collective (I2).

4 Changes that result from peatland restoration

We identified benefits and disbenefits associated with peatland restoration, with data drawn from PA forms and interviews wherever appropriate.

4.1 Benefits from peatland restoration

We found a high degree of overlap and synergies across environmental and social benefits, and applicants acknowledged the multiple benefits and knock-on positive effects from peatland restoration. For example, some of the projects reported a reduction in water flows which they expected would reduce flood risks and discoloration of water supplies and, in turn, decrease water treatment costs. Similarly, another project reported an improvement in the generating capacity of a hydro scheme due to runoff attenuation from the creation of new pools which also improved the amenity value of the site.

All PA forms reported environmental and socioeconomic benefits. Some of the most frequently observed benefits are:

- Changes to the hydrology by improving the water holding capacity and, as a result, reducing the runoff and slowing down water flows. These changes to the hydrology are expected to lead to a reduction in flood risks, drinking water treatment costs and biodiversity improvements.
- Prevention of further peat erosion and retention of existing carbon stores. Peat stabilisation is expected to reduce carbon loss both through oxidation and water flow.
- Habitat improvement through re-vegetation as well as creation of pools and wet areas.
- Improvement to the landscape by reducing the visual impacts of grips and gullies.

There is considerable overlap between environmental and socioeconomic benefits from peatland restoration given that many of the environmental benefits are public goods. Examples include:

- Long-term flood risk reduction, reduction in water treatment costs, and helping the Scottish Government meet climate targets.
- Enhanced landscape views and improved biodiversity and habitat linkages are also seen as societal benefits from restoration.

- The improved ability of local communities to access, enjoy and engage with peatlands. This has helped increase awareness of the importance of local peatlands by engaging actively with a range of groups (e.g. school pupils, wildlife groups, volunteers, general public).

Other socioeconomic benefits frequently mentioned are the creation of local employment opportunities, particularly in remote rural areas. For example:

- Employment of local contractors and training opportunities in peatland restoration techniques.
- Local farmers may benefit from a reduction in scrub encroachment and from less water leaving project sites which would otherwise affect neighbouring farmland.
- Better access to restored sites could ease their future management, for example, with grazing.

4.1.1 Monitoring and recording

In some cases, projects indicated that it was too early to report benefits to business while, in others, none were reported. The PA forms that recognised benefits to businesses highlighted:

- Experience and knowledge gained in project management and peatland restoration techniques
- A potential reduction in chick mortality and stock losses in ditches
- Improved access for stock management and creation of a larger area for grazing animals
- Peatland restoration fitted well with their organisation's objectives. While in many cases these were environmental organisations, it is worth noting that integration with farming activities and deer and grouse moor upland management were also mentioned
- Publicity and attention to conservation goals

It should be noted, however, that PA forms do not report a systematic monitoring of these environmental benefits. In some cases, water quality and water flow were monitored but reports indicate that these data were not available yet and hence not reported. More broadly, the Research and Monitoring Group (under the umbrella of the National Peatland Plan) is considering a more strategic approach going forward.

Interviews emphasised the benefits that people believe will happen by engaging in peatland restoration. These align with the benefits summarised above, including carbon sequestration, biodiversity improvements, and social benefits:

> *"[…] it's a combination of sort of the biodiversity and the climate change, but also I think some of the social benefits. So we've had a few estates sort of commenting on the restoration that they've undertaken and you know, sort of some of the restoration is being close to paths that are used by hillwalkers, for example" (I1.2)*

4.2 Disbenefits from peatland restoration

Most forms did not report any negative effects or disbenefits from peatland restoration. Where these were identified, issues included:

- In some cases, projects reported temporary cashflow issues

- In one case, where peatland restoration involved tree removal, this created a negative public perception from the loss of the woodland.
- One of the projects reported a potential conflict with part of the timber industry which has a negative view of large-scale forest to bog restoration projects.
- Another project reported that the tight timeline, to which the projects have to be delivered over the winter months, might encroach upon people's personal time, thus temporarily affecting their personal and social life. While this may not affect larger scale projects, it may be a concern for smaller landowners.

Interviewees did not report any actual negative impacts of restoration, but they focused mainly on perceived disbenefits, as addressed above in Section 3.3.

4.3 Learning from peatland restoration

The benefit of gaining knowledge was also identified across four areas[4], namely:

- Ecology and hydrology of peatland restoration
- Peatland restoration practices and techniques
- Managing projects and specialised contractors in a peatland setting
- Understanding the carbon benefits of peatland restoration and relevance to the proposed project

Figure 1 shows the change between self-reported knowledge recorded before and after carrying out restoration projects, with an increase occurring across all domains. The largest increment was detected for the areas of 'ecology and hydrology' and for 'carbon benefits of peatland'. Knowledge about managing projects and specialised contractors rose too, although by less compared with the increases in the other areas.

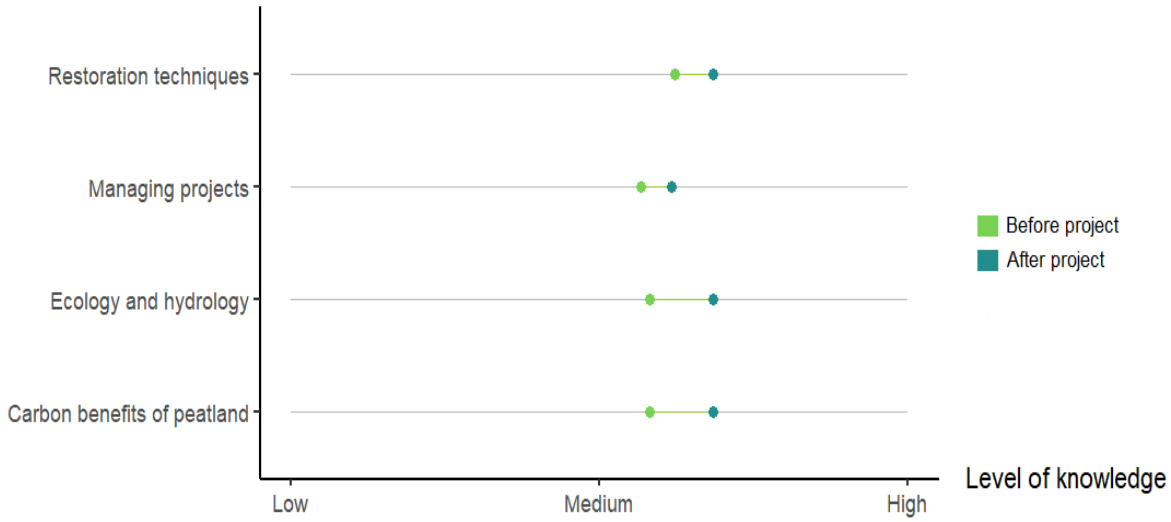

Figure 1: Self-reported knowledge on peatlands and peatland restoration

[4] We found evidence in the qualitative answers provided in the PA forms and in an additional question included in the forms and focusing on the level of self-reported knowledge (as going from "Low" to "High").

5 Challenges of peatland restoration

5.1 Environmental challenges

Environmental challenges reported by applicants vary, with some being the result of conditions or events during restoration, while others are the result of past events.

5.1.1 Environmental challenges from present conditions

A large share of these challenges refers to weather conditions which can impact on timing. Snow creates problems most frequently for restoration, but strong winds, heavy rain or ice along the access track are also reported. In addition, events such as bird nesting and lambing season, contribute to the slowdown of restoration works or even to their complete interruption. When anticipated by land managers and contractors, the presence of unfavourable weather conditions contributed to *"[being] particularly realistic when setting out restoration targets".*

The general level of erosion and the landscape structure itself can make it difficult to access sites. In fact, some sites are found in remote, elevated or steep locations. Alternatively, it can be specific areas of interest (e.g. gullies) that are inaccessible to machines; local environmental conditions (e.g. ground conditions) are not suitable for works as set out originally, thus imposing a review of the plan.

5.1.2 Environmental challenges from past events

A further category of environmental challenges emerges from past activity. There are, in fact, many areas of overlap when people talk about environmental challenges and when they talk about the history of the site.

On the one hand, this can be in the case of some ecological trend specific to the site (e.g. wildfires having been particularly frequent and/or intense over the previous years) or of recent weather patterns (e.g. spring and summer of 2018 being particularly dry, especially in the Highlands, and affecting vegetation recovery).

Alternatively, they can be the result of previous human interventions to the site. For instance, clay piping, plastic piping, tunnel ploughing and drains have all been cited to this regard – particularly drainage networks, *"creating an artificially low water table preventing effective peatland restoration" (PA form)*. However, the PA forms do not provide evidence as to how this may be linked to previous guidance or guidance inconsistency over time.

5.2 Challenges during restoration activities

Key challenges encountered during restoration are closely tied to, or a direct consequence of, the environmental challenges described above. For example, general logistical problems are often mentioned, frequently resulting from the land being hard to access or to work with, and from adverse weather conditions that in turn affects project scheduling[5]. Either extra work or a revision of the plan may be required.

[5] A recent CxC report[12] also points at this factor limiting the area of peatland that can be restored each year.

Some challenges seem to come directly from the assigned contractors, for example, how best to monitor satisfactory standards, both for actual restoration activities and for the mobilisation phase (resulting, more than once, in track damage to the site). This raised the issue of appropriate training. Alternatively, there may be tight time limits to which the project has to be delivered, which can be hard to combine with contractors' availability.

Communication between key actors can also be challenging, potentially touching on every part of the system. We found examples of poor communication from contractors to the Peatland Action officer, or from contractors to the land managers, that led to problems during restoration. Problems also arose between other actors, for example, in cases particularly where several parties were involved (estate farm manager, estate factor, agents, tenant farmers, Scottish Natural Heritage (SNH, now NatureScot) project officer, contractors). This is particularly relevant when considering that, if communication flows are kept active and efficient, they can actually be a success factor for the project ("*Close communication with contractors and their resilience and ability to work through inclement winter weather, however, has made it possible to complete the project work*").

Wider partnerships can also bring clashes between differing visions and objectives. More than once, in fact, applicants report that challenges arose when organisations needed to coordinate; for example, where extra discussions were needed to decide specific aspects of project implementation, such as liaising with Forestry Commission Scotland to understand which trees could be removed and obtain licences, or the suggestion of a need for planning consent for which intervention from others (e.g. SNH or RSPB) was required.

5.3 Challenges with grant process

We found some reports of applicants being unhappy with the application process, mainly related to:

- Delays in the approval of funding
- Application and reporting material being daunting

Two substantive consequences were identified. Firstly, delays in approval can delay the start of the restoration works, tightening the timespan for completion of the project or simply pushing the start date further into the late autumn and the winter months. Secondly, potential applicants may be put off by what they perceive as daunting paperwork, creating a barrier to uptake of peatland restoration.

In one interview, the current configuration of funding and funding sources raised concern:

> "[…] *the funding for peatland restoration is now split up as you understand better than me, and I think we found that a bit confusing, we found that's not as easy. So it's been fine. Peatland Action has already designed it, Scottish Water funded the restoration and that was OK, but it makes the project just a bit more complicated to have all these different strands of funding rather than Peatland Action doing it and kind of maintaining the kind of overview on standards and so on and so forth." (I5)*

5.4 Funding access and availability

Funding availability was mentioned in several responses, across both the interviews and PA's reporting information, as the following examples show:

- Not being able to secure multi-year funding, and having to spend all the money by an early date leads to start-and-stop situations which are unhelpful from the financial point of view, thus hindering the willingness or the ability to engage in significant restoration efforts.
- This creates potential restoration challenges, especially the weather-related ones: if landowners and contractors are not able to finish works in time, they are left uncertain about whether they will be able to access funding in the next round to conclude the project.
- Land which is regarded as agricultural is treated differently, in financial terms, from restored peatland, which creates concerns among some big estates which are more reluctant to engage in restoration because of the fears of being hit with high tax bills.
- Lack of funding or availability of limited funding have reportedly led to restoration works not being executed or to the need to focus on high priority areas instead of being able to tackle other areas of peatland that would benefit from restoration too.

At the same time, however, Peatland Action has sometimes been reported as the source of funding which compensated for the lack of funds in some areas, particularly remote ones (such as North Highlands).

5.5 Interaction between challenges

Our analysis highlights a potential connection between different challenges, graphically represented in Figure 2.

For instance, delays in the funding process are at risk of contributing to a delayed start of restoration works, which might be pushed further into months with more adverse weather.

When weather conditions are particularly unfavourable, they both contribute to the exacerbation of existing environmental challenges on the site and become a challenge of their own.

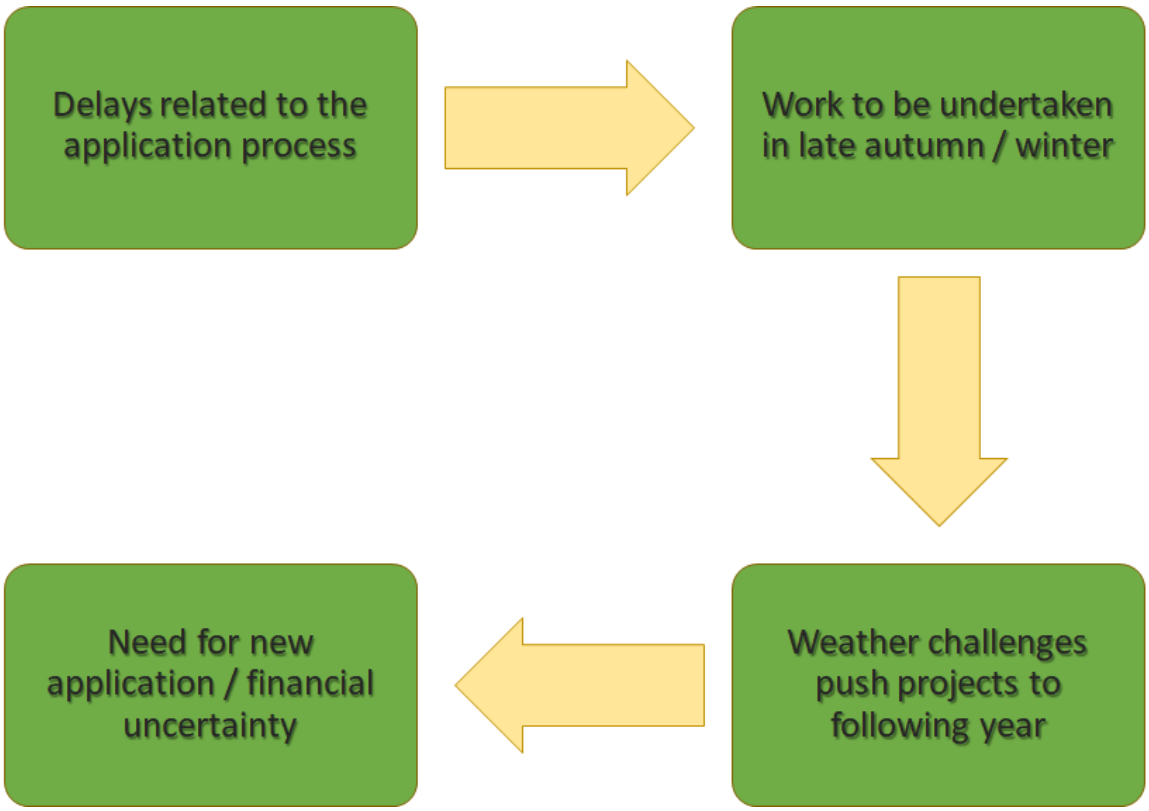

Figure 1: Potential relationship between different types of challenges

A possible result is that restoration activities are slowed down, completed only partially, postponed or completed to a lower standard. In all such cases, this might result in the need to prolong projects to the following year.

This condition, in turn, could be reflected on the financial sustainability of restoration projects – especially if there is no security of multi-year funding.

6 Community engagement and role of partnerships

Community engagement played a key role in a few of the PA forms reviewed, although in some cases engagement was limited by remoteness and difficulty in accessing restoration sites. The key themes that emerged in relation to engagement are:

- Peer-to-peer learning
- Role of early engagement

A common theme was how engagement provided an opportunity for learning. Learning from existing projects may encourage other landowners to engage in restoration and foster larger scale restoration requiring collective action across the landscape.

Some projects mentioned that early engagement with landowners facilitated restoration, particularly through talks and walks and conducting feasibility studies. In addition, early consultation with local communities to explain the long-term benefits of a project can help to raise awareness and address negative public perceptions. This is particularly the

case where peatland restoration conflicts with other landscapes that are valued locally (e.g. woodlands). Also, as acknowledged by an interviewee, the link to something tangible, such as improving water quality, facilitated engagement and participation:

> *"So what's worked the best for us […] it was easy or […] pretty easy to engage because everyone could understand this was about drinking water so everyone got it straight away [...] so we linked it to something that people understood." (I4)*

Embedding Peatland Action officers in other organisations was also recognised to facilitate engagement by building up connections across different stakeholders and organisations:

> "*…think it's worked really well that [..] works for us because I think it gives an access to community and community land owners […] He's worked on other estates first, so it's giving him contacts to other estates, […] attends the Deer Management Group and things like[..] just to help build up relations with them, you know, just to make sure they're well connected to each other as well." (I4)*

A wide range of engagement approaches were mentioned, including:

- Events targeting landowners and estate keepers, such as demonstration events
- Events addressing local communities and the wider public, such as open days and talks
- Hosting volunteers participating on the restoration activities and learning about the techniques
- Interpretation and signing on sites
- Online videos and posts, e.g., Facebook

As one report recognised, the uncharismatic nature of peatlands can make engagement challenging; a combination of approaches may be required. For example, in one of the projects, engagement activities took place both locally and in urban areas to reach out to audiences who may be unfamiliar with peatlands.

Several projects reported using creative methods, such as drama and films, to engage communities. It was also acknowledged that links with arts and heritage helped to overcome some of the barriers by engaging in new and creative ways.

Interviewees suggested that since Covid-19 restrictions started, online events have become a good alternative, enabling wider accessibility and the organisation of more ad-hoc meetings. While this is something that can be combined in the future with face-to-face meetings, for some groups (such as crofters) face-to-face meetings may still be the best approach:

> *"[…] once we can start meeting again […] this is often a way that works really well with crofters. A lot of crofters are older, […] and don't necessarily see all the propaganda messages that go out on the Internet […] getting people in into halls to have discussions works really well." [I2]*

In the particular case of the crofting community, one of the interviewees indicated that further engagement was required:

> *"I think there hasn't been nearly enough engagement, and I think it's a shame because I think a lot of crofters would be willing […] crofters aren't all small scale obviously, because the common grazings are usually quite large tracts of land, and if you add up all the common grazings together, there's something like*

500,000 hectares of common grazing. 570,000 or something like that? […] get the Croft on board and you straight away will see results". (I2)

Another key issue is the role of partnerships in facilitating larger landscape scale restoration. Partnerships often:

- Involve different stakeholders aiming to restore peatlands as part of a longer-term vision
- Help to find convergence between farming and conservation interests
- Result in greater benefits across the peat network, maximising the impact of the restoration work, and enabling projects to progress more easily and quickly

However, it is worth noting that the number of parties involved can also bring about some communication and coordination challenges (see section 5.2).

7 Lessons learned for enhanced uptake of peatland restoration

Interviewees highlighted a number of 'lessons learned' to help boost uptake of Peatland Action or similar projects. These centre on the key themes of:

- Targeting promotion efforts and engagement
- Funding parameters
- Access to resources

In addition, data from the PA forms provide suggestions on key actions to encourage land managers to participate in peatland restoration.

7.1 Promotion and engagement efforts

It was noted that some promotional materials are geared more towards larger landowners and estates, and that smaller businesses (e.g., crofters, family farms) need to be engaged in a different way. Simple measures such as creating physical leaflets, paying attention to language used, organising farm walkovers, explaining the benefits, and sharing of experiences between neighbours and peers would be effective in communicating on the topic with smaller landowners who may have less flexibility in time or resources to spend on learning more about the initiative (I1; I2; I5). Uptake could also be improved by communicating better on the less familiar elements of the initiative (I3):

"[There] needs to be just, in general, better communication with land managers about the merits of the restoration, the funding that is available and trying to overcome sort of people's sort of inertia on it … you can address some of these things locally. I mean, like the communication and the clarity of eligibility for ongoing support." (I3)

"I think also some people, probably just don't understand or fully recognise like the benefits of doing this or … the rationale behind it. But yeah, I think making any kind of incentive, or you know if we're encouraging people to carry out measures, it really needs to be accessible … since lockdown began last year, we've done a lot more online events that people connect into while they're at home, and they've been really, really popular, and I've been really surprised by how much uptick we've had and how much engagement we've had ... and I

suppose it kind of relates to if you're trying to engage more farmers and things making things very accessible. Very kind of visual and quite straightforward." (I5)

It was also recognised that wider promotion of the benefits of peatland restoration would allow a more holistic and industry-wide adoption of the mindset, and would remove some of the burden from the individual land managers who may implement a restoration project:

"We need to look at not just looking at farmers and land managers and ... improving their climate literacy or their understanding of peatland restoration, but also looking at the people who come onto farm so like their consultant, their vet. And anybody who's coming into contact with them ... if you can train all of those people who were all talking the same language and all in the same message, I think it will be much more kind of impactful ... training those people [the people farmers engage with regularly] - trying to practice like holistic approach to awareness raising rather than just being like 'you farmer: please learn about this'." (I5)

Related to the point on sharing experiences, it was noted that there is room to improve recognition of historical good practice in land management (I2). Sharing traditional approaches would help to include land managers who have maintained peatland environments and demonstrate that they can function in their 'natural' or restored state:

"There's no recognition of the fact that a lot of people didn't wreck peatland and we're managing it really well ... something that we're going to be really pushing for is that there needs to be more recognition of good practice and the continuance of good practice." (I2)

7.1.1 Current engagement channels

In forms submitted to Peatland Action, applicants are asked how they heard about the funding scheme. Figure 3 displays the current distribution, showing that the vast majority of people learned of the scheme through Peatland Action officers, while a small share were informed by consultants.

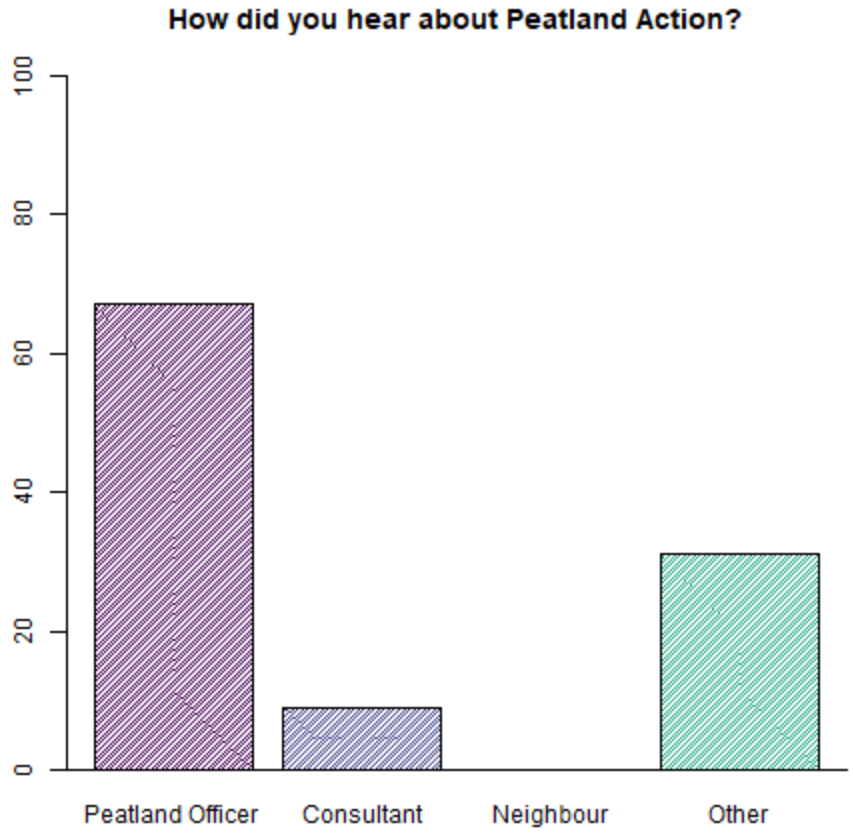

Figure 2: Main channels to hear about Peatland Action

Among the channels that contribute to the “Other” option and which applicants have later specified, the following appear:

- Communication with SNH (now NatureScot) or RSPB
- Engagement in existing forums or groups (e.g. Tweed Forum, deer management groups, land estates etc)
- Websites (Peatland Action, SNH (now NatureScot))
- Peatland restoration demonstration days.

What stands out is that no one reported hearing about the funding scheme from neighbours. This might sound surprising, especially because it emerged from the interviews that neighbours are expected to play a key role in the spread of peatland restoration projects across landscapes.

However, it should be noted that the role of neighbours in the spread of peatland restoration can be, and is expected to be, of a deeper nature than just publicising the existence of funding. Specifically, neighbours can play a crucial role in learning from and legitimising the experience of restoration – especially in contexts where barriers to uptake are not lack of knowledge about the existence of the schemes, but rather other perceptions and beliefs about restoration, as the following extract shows:

> *“[…] people have a perception beforehand that they're just going to be told "No peat cutting" and if someone cuts their banks they’re going to be fined. […] so I do think there's a domino effect, that's just... it's a bit like community land ownership: once a few do it and do it well, then others want to do it too.” (I5)*

7.2 Funding parameters

The duration and timing of funding opportunities were also cited as problematic in practical terms. Funding mechanisms which do not allow for follow-on work or multi-year work can deter potential participants from applying. It was recommended that farm and land-based cycles be considered as part of the funding scheduling. Events such as lambing and bird nesting seasons, as well as winter weather and short days, preclude large sections of time within the year from carrying out physical works; these need to be reflected in the funding / spending deadlines (I1). The system by which funding is allocated was questioned in terms of how it seems to favour larger land owners and businesses. It was suggested that the points system which, for example, rewards engagement with consultants, lends itself better to larger land managers and that a re-design of the merits and / or facilitation of collaboration between collectives of smaller land managers would help the initiative to be more inclusive:

> *"Reaching out to these groups of people designing it [the restoration initiative] so that it can be adopted by people paying attention to scale … crofters aren't all small scale obviously, because the common grazings are usually quite large tracts of land, and if you add up all the common grazings together, there's something like 500,000 hectares of common grazing … it's a large area of land and an awful lot of that will be peatland." (I2)*

7.3 Access to resources

Access to a range of resources appears to be problematic for some potential participants. These include time/money/labour to engage with the funding process and the physical equipment required to carry out the restoration. It was noted that key engagement requirements should include details on what support would be available for the landowners (e.g. someone to facilitate completion of applications, reporting etc.) (I4), what post-project monitoring would be required or provided (I1) and resources to allow potential participants to learn from one another about the successes but also the challenges of the process (e.g. some form of support forum or showcasing of past / ongoing projects) (I5).

> *"I think we need to start looking at showing people that start their journey and showing … mistakes, [they] have overcome them, and having this kind of peer-to-peer learning - facilitating that [and] also highlighting the 'everybody's kind of fallible' because it's very easy for you to dismiss somebody [be]cause you can say like 'Oh well, they've got, you know, they are big bigger business than me ... If I did [a restoration project], you know, there's a reason for that not working'. So I think we need to facilitate that peer-to-peer learning and look at who's delivering the message."* (I5)

Training resources were also mentioned as a necessary instrument to ensure works are carried out to satisfactory standards, even in the most challenging locations.

In terms of physical provision of specialist equipment, it was suggested that a pooling or shared hire system would alleviate concerns from a number of potential participants (I1; I5) and that the current Scottish Government effort to train more people in using the equipment has been helpful (I3).

7.4 Actions to encourage other land managers

PA forms asked applicants to rate (from “not important” to “very important”) six actions that may be used to encourage other land managers to become engaged with peatland restoration. These are:

- Provide better/more information on the impacts of restoration
- More awareness raising / training events
- Facilitate application process
- Guarantee of no loss of single farm payment (or post-Brexit equivalent)
- Provide means of funding up-front costs
- Include peatland maintenance/management payments in future agri-environment schemes

Overall, there is a good level of consistency in deeming all actions important. In addition to rating, PA forms asked some[6] of the applicants to rank the three most important actions among the ones discussed above. The actions that stand out as most relevant to engage land managers in peatland restoration are: providing better/more information, providing means of funding up-front costs, and facilitate the application process.

The point on improving information is consistent with what has been already observed here about closing the knowledge gap regarding what peatland restoration is, what benefits it can contribute and what it entails in terms of land management.

At the same time, facilitating the application process addresses what has been already highlighted here as a barrier to engagement - which suggests that acting on this aspect can be a leverage point to increase the uptake of peatland restoration projects.

8 Conclusions

This research has examined current experiences with peatland restoration in Scotland, drawing mainly on evidence from the Peatland Action programme, complemented with five key interviews. The main findings are summarised in an analysis of strengths, weaknesses, opportunities and threats (SWOT) and in an analysis of political, economic, social, technological, environmental and legal (PESTEL) factors. These analyses are presented in Appendix F.

Peatland restoration can deliver multiple environmental and social benefits, such as improving carbon management, biodiversity, and water regulation, and create knock-on positive effects, such as reduction of flood risks and water treatment costs. Our analysis also identifies barriers to engagement with peatland restoration including: wider impacts on how land is managed, lack of knowledge or understanding of the benefits, process and support available for restoration, and cultural clashes from loss of traditional uses.

There are opportunities to improve engagement by communicating better the benefits and the support available. Targeting communication efforts and engaging further with smaller landowners, such as crofters, could also help to increase uptake. Peatland restoration requires building up connections across stakeholders and, for this purpose,

[6] Not all PA forms included this question. Forms from funding year 2017-2018 asked people to rank the three most important actions out of the six available. Forms from 2018-2019 and 2019-2020 asked to rate (from "not important" to "very important") all of the six actions. Therefore these two groups of forms have received different treatment.

partnership working has proven useful in a number of cases. However, this often requires facilitation and support to manage the different goals and needs of the parties involved.

At the time of writing, PA funding is rolled out on a yearly basis, which limits the time available for restoration works and hence the scale of the restored area[7]. Alternatives to this would be to consider multi-year funding to increase the ability to engage in significant restoration efforts and/or to take into account farm and land-based cycles for scheduling of the funding. Training on the use of specialist equipment and developing a pool or shared hire system of equipment could also help to address some of the direct barriers linked to carrying out restoration works.

While the results presented here offer rich insights into the experience of early adopters, they do not provide in-depth detail on why some landowners do not engage with peatland restoration or drop out of the programme. These gaps are partly addressed by the key interviews included in the report. However, a better understanding of the experiences and challenges faced by smaller landowners, and in particular crofters, could help to inform future restoration initiatives.

[7] The advice for potential applicants to Peatland Action in 2021 now states "Building on the work undertaken to date we are now also looking to fund large-scale projects over multiple years, for which we will, where appropriate, make multi-year offers." https://www.nature.scot/climate-change/nature-based-solutions/peatland-action/peatland-action-fund-how-apply

9 References

[1]Clark, J.M., Gallego-Sala, A.V., Allott, T.E.H., Chapman, S.J., Farewell, T., Freeman, C., House, J.I., Orr, H.G., Prentice, I.C., Smith, P., 2010. Assessing the vulnerability of blanket peat to climate change using an ensemble of statistical bioclimatic envelope models. Climate Research 45, 131–150.

[2]Evans, M., Warburton, J., Yang, J., 2006. Eroding blanket peat catchments: global and local implications of upland organic sediment budgets. Geomorphology 79, 45–57.

[3]Wallage, Z.E., Holden, J., McDonald, A.T., 2006. Drain blocking: an effective treatment for reducing dissolved organic carbon loss and water discolouration in a drained peatland. The Science of the Total Environment 367, 811–821.

[4]BRIG, 2011. UK Biodiversity Action Plan – Priority Habitat Descriptions. JNCC, Peterborough.

[5]Artz, R., Chapman, S., Donnelly, D., Matthews, R., 2012. Potential Abatement from Peatland Restoration. ClimateXChange enquiry number 1202-02. Edinburgh, ClimateXChange.

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[7]Glenk, K., Schaafsma, M., Moxey, A., Martin-Ortega, J., Hanley, N., 2014. Valuing peatland restoration for spatially targeted ecosystem service delivery. Ecosystem Services 9, 20–33.

[8]Byg, A., Martin-Ortega, J., Glenk, K., Novo, P. (2017) Conservation in the face of ambivalent public perceptions – The case of peatlands as 'the good, the bad and the ugly'. Biological Conservation 206, 181-189.

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[11]Glenk, K., Novo, P., Roberts, M., Sposato, M., Martin-Ortega, J., Shirkhorshidi, M., Potts, J. (2020) The costs of peatland restoration: Analysis of an evolving database based on the Peatland Action Programme in Scotland. SEFARI report.

[12]Artz, R., Ball, J., Gimona, A., Blake, D., McBride, A. (2019). Access to peatland for restoration – physical limitations. CxC report. https://www.climatexchange.org.uk/media/3872/access-to-peatland-for-restoration-physical-limitations.pdf

Appendix A

The introductory information and detailed form are set out here for ease of reference. This is a copy of the Final Report template for the 2017-18 funding round that PA grantees had to fill at the end of the project.

Peatland Action Fund – Final Report

Project reports

A summary report must be produced for each practical restoration project funded by Peatland Action once work is completed. These reports are a requirement of the Peatland Action funding. These reports have been developed based on research from Scotland's Rural College, the University of Leeds and The James Hutton Institute[8].

Completed reports may be used by Scottish Natural Heritage (now NatureScot) to help raise awareness of the range of peatland restoration work we are funding, and the benefits it can bring. Writing style for the open questions should be journalistic – telling stories, showing how challenges were overcome and what helped to achieve goals. The information gathered from these reports may also be used for research purposes and released under an open licence (information on costs will be anonymised).

The final report should consist of two components:

1. A completed version of **this document**
2. **A folder containing photos** that represent your project. These should show before, during and after photos, preferably of all restoration techniques and machinery used. Name the folder:

   '*Project ID code_Project name*_FinalReportPhotos_Date'

   e.g. '500123_Lower_Moss_Peatland Restoration_FinalReportPhotos_2017_05_21'.
   Please use YYYY_MM_DD for date format.

   Please provide details of each photo in the 'Photos' section of the "Details of Restoration Techniques" at the end of this form.

Please note that final reports are only required for practical restoration projects funded by Peatland Action.

Please only complete those sections where information is readily available.

Double-click on Yes or No box to open, and select 'Checked' option as appropriate. Where needed, please add additional lines to tables.

[8] Glenk, K. and Martin-Ortega (2018). The Economics of Peatland Restoration. Journal of Environmental Economics and Policy; Byg, A. & Novo, P. 2017. Peatland Action Programme – lessons learned. ClimateXChange report.

Please note that we may use some of the images and project report information on our project website.

Finally, in order to complete this form **you will need to have a copy of your Peatland Action application form for reference**.

Section A - About you

1. **Lead Organisation (if applicable**)

Section B - About your project

2. **Application ID's**

3. **Project title**

4. **Grid reference**

5. A line / sentence / quote as a captivating statement about the project (*could be from the project manager or a stakeholder*)

6. Mini sections (please use snappy subtitles if possible) (*max 750 words in total*)

    6.1. Introduction (*goals/mission of the project/original problems/drivers*)

    6.2. Site basics (*project area, peatland type, key species present, restoration ambition, restoration area achieved, restoration methods*)

6.3. *History and challenges overcome (why did the project come about? Were there any barriers to progressing the goals? If so, how did you overcome them?)*

6.4. Benefits (*In the context of your project, what are some of the benefits of the work you have undertaken? Who is likely to benefit from the work you have carried out?*)

7. Did the project involve any partnership working and/or make links with any other projects? (e.g. Central Scotland Green Network, Pearls in Peril) if so, please briefly describe:

8. Please provide details about the Peatland Action Fund restoration projects by completing the table below. The site ID, name for each site and Central Grid Reference should correspond with the information provided in Question 24 of Application form. Please complete this information and then indicate actual area affected and visible changes you notice on each restoration site. If activities have not been carried out in any of the sites included in the Application form, please leave blank. If new sites have been added, please add them to the table.

Site ID	**Name for each site** *(As given in Q20 of the Application form)*	**Central Grid Reference**	Area of **each peatland site** in hectares (ha) restored **through activities funded under this grant** Consider the total area *affected* by restoration – this may be greater than the area in which you conducted restoration activities **Note that the area affected may or may not have changed compared with Q20 in Application Form. Please just state here the area affected as of now.**	**What are the visible changes you have noticed on the site?** (multiple answers possible)	
1				Standing water	
				Water colour	
				Vegetation: bare peat covered	
				Vegetation: Sphagnum	
				Fauna: birds	
				Fauna: insects	
				Better sheep/livestock health	
				Improved grouse survival rate	
				Other (specify)	
2				Standing water	
				Water colour	
				Vegetation: bare peat covered	

				Vegetation: Sphagnum	
				Fauna: birds	
				Fauna: insects	
				Better sheep/livestock health	
				Improved grouse survival rate	
				Other (specify)	

Site ID	**Name for each site**	**Central Grid Reference**	Area of **each peatland site** restored (ha)	**What are the visible changes?**	
3				Standing water	
				Water colour	
				Vegetation: bare peat covered	
				Vegetation: Sphagnum	
				Fauna: birds	
				Fauna: insects	
				Better sheep/livestock health	
				Improved grouse survival rate	
				Other (specify)	
4				Standing water	
				Water colour	
				Vegetation: bare peat covered	
				Vegetation: Sphagnum	
				Fauna: birds	
				Fauna: insects	

				Better sheep/livestock health	
				Improved grouse survival rate	
				Other (specify)	
5				Standing water	
				Water colour	
				Vegetation: bare peat covered	
				Vegetation: Sphagnum	
				Fauna: birds	
				Fauna: insects	
				Better sheep/livestock health	
				Improved grouse survival rate	
				Other (specify)	
6				Standing water	
				Water colour	
				Vegetation: bare peat covered	
				Vegetation: Sphagnum	
				Fauna: birds	
				Fauna: insects	
				Better sheep/livestock health	
				Improved grouse survival rate	
				Other (specify)	

9. Please provide details about the actual restoration activities implemented on each site. Activities may or may not have changed compared with Q21 in your Application Form but please report here what has actually been implemented. The site ID should correspond with Question 8 above. Please give details about the techniques in the tables in the Details of Restoration Techniques section at the end of this Report.

1	2	3	4	5	6	7

Site ID	Hag & gully blocking		Ditch blocking		Peat dams	Wave dams	Plastic dams	Stone dams	Timber dams	Hag & gully re-profiling	Ditch re-profile	Bunding	Surface smoothing
	m	ha	m	ha	no.	no.	no.	no.	no.	m	m	ha	ha
1													
2													
3													
4													
5													
6													

1	8	9	10	11	12	13		
Site ID	Forestry – tree removal	Scrub removal/mgt	Forest mulching	Peat pan stabilisation	Living mulch	Other This includes: e.g. bare peat, brash removal or crushing. Please specify:		
	ha	ha	ha	ha	ha	Description	m (as appropriate)	ha (as appropriate)
1								
2								
3								
4								
5								
6								

10. If there were any changes compared to the initially-planned activities in Q21 of the Application Form, please provide a brief description of these changes and the reasons for them. Please make reference to the site ID where the changes have taken place. The site ID should correspond with Questions 7 and 9 above. If there were no changes, please leave blank.

Site ID	Changes compared to Application Form and reason(s) for change (brief description)
1	
2	
3	
4	
5	
6	

11. If any monitoring has taken place within the restoration area, for example, water quality or vegetation monitoring, please specify and submit results with this report if not already sent to us.

Section C - Your costs

All costs must be broken down by financial year (01 April to 31 March).

Project costs - we need to know:

- Cash costs of your project. A cash cost is an item you will have to pay for such as buying a piece of equipment or hiring a venue or piece of equipment, or paying for sub-contractors. Please, note that we are interested in the total **cash cost** of your project – this includes all cash items even if you're not looking for us to fund them.
- Non-cash costs: A non-cash cost is an item donated to the project at no actual "cash" cost to the project such as volunteer time, services or materials.

COSTS - SITE BASED RESTORATION ACTIVITY

CASH COSTS

12. Please provide a breakdown of all the **actual cash costs** (staff, machinery, equipment, sub-contractors, etc.) incurred on each site. These include **CASH** costs which have been claimed from the Peatland Action fund and costs covered by your own or third party funds. Please **do not** include in-kind contributions here.

Site ID	Project Cost Description	Cash Cost 2017-2018	Cash Cost 20xx-20xx

13. In those cases where your costs have changed with respect to those indicated in Q37 of the application form, please specify reasons for changes in cost per site (if no change, leave blank).

Site ID	Reason(s) for change (brief description)

14. Please list below any cash costs that are not associated with a specific site (e.g. demonstration events, community engagement activities that may have been listed in Q38 of the Application form. Please do not include in-kind contributions.

Activity description	Cash Cost	Cash Cost

	20xx-20xx	20xx-20xx
Umbrella funding to the MDMG was provided, which is reported on elsewhere	£	£
	£	£
	£	£
	£	£
	£	£

15. If additional (non-Peatland Action) funding was secured as part of the project, please provide details:

IN-KIND CONTRIBUTIONS

16. Please tell us about any in-kind contributions, including your own. Please provide an estimate in £ of the actual total incurred in-kind contributions by your or any third-party organisation, that may have been listed in Q41 of the application form. This may include use of equipment or machinery, or materials that may be given to the project without charge.

Contributor	Description of in-kind contribution	Estimated Cost 2017-2018	Estimated Cost 2018-2019
		£	£
		£	£
		£	£
		£	£
		£	£
	Total	£	£

*pro rata equivalent

17. Please provide an estimate of the total time used in restoration related activities (approximate total number of days of all people contributing labour time). With total time we mean time contributed in-kind by your business or organisation. This can include yourself or salaried workers but excluding sub-contractors.

Number of days ☐ Estimated value of time given £

18. Please provide a percentage of the total time indicated above that was spent on each phase of the restoration project:

Project phase	%
Planning: (preparing application; training/information gathering; contacting suppliers; organising work; preparing (access to) site etc.)	

Implementation: site specific activities: (implementing specified activities)	
Implementation: non-site specific activities: (community engagement and awareness raising activities etc.)	
Post-implementation: (monitoring progress; maintenance; final reporting)	

19. Was social media (e.g. Twitter, Facebook, Instagram), public media (e.g. TV, radio), or a public event(s) used to promote the project? ☐ Yes ☐ No

20. If Yes, please briefly describe:

	Brief Details *(including number of people engaged)*
Facebook *Total number of likes/comments/shares*	
Twitter *Total number of likes/retweets/favourites*	
Instagram	
Website *Number of views*	
Blog *Number of views*	
Newspaper reports *Circulation of publication*	
TV	
Radio	
Other	

21. If you have hosted any demonstration events and/or community engagement events, please briefly describe them and tell us how many people attended each:

22. How many volunteers were involved with the project?

23. If schools were involved, how many students were engaged with the project?

Section D – Your experience with restoration

24. We are interested in your views on the restoration project. Please tell us:

How would you rate:	1: very bad 5: very good
your overall experience with the peatland restoration project	
your experience with the funding application process	
your experience with the support available from SNH and Peatland Action Officers	
your experience with dealing with suppliers	
your experience with the outcomes of the project so far on the ground	
your experience with the way restoration fits with your business/organisational objectives	

25. If the restoration project so far has had any positive effect on your business or organisation, please briefly describe:

26. If the restoration project so far has had any negative effect on your business or organisation, please briefly describe:

27. Would you consider restoration on some other sites?
☐ Yes, if funded ☐ Yes, in any case ☐ No ☐ I don't have any other sites

If yes or no – why?

28. Please, rate the following actions that may be used to encourage other land managers to become engaged with peatland restoration:

	1: not important 5: very important
Provide better/more information on the impacts of restoration	
More awareness raising / training events	
Facilitate application process	
Guarantee of no loss of single farm payment (or post-Brexit equivalent)	

Provide means of funding up-front costs	
Include peatland maintenance/management payments in future agri-environment schemes	

29. Please rate the features of the Peatland Action funding process that should be retained in the future.

	1: not important 5: very important
Low cost	
Low hassle to land managers	
Ease of application procedure	
Quick reimbursement	
Flexibility in implementation	
Learning and experimenting opportunities	
(semi)-independent advice	
Quickly visible results	

30. What should be improved or changed in the Peatland Action restoration process? Please provide below suggestions you may have for improving either restoration or the process:

31. Have you heard of the Peatland Carbon Code? ☐ Yes ☐ No

32. How would you rate your level of knowledge about peatland restoration?

Area of knowledge	**Low (L)**	**Medium (M)**	**High (H)**
Ecology and hydrology of peatlands and restoration			
Peatland restoration practices and techniques			
Managing projects and specialised contractors in a peatland setting			
Understanding the carbon benefits of peatland restoration and relevance to the proposed project			

33. Please let us know if you would be happy to be contacted for research purposes related to restoration? ☐ Yes ☐ No

Peatland Action Fund – Final Report Details of Restoration Techniques

Please complete sections 1: Dates and 2: Photos and all other sections that are relevant to the restoration techniques applied in your project (**N.B. Please only complete those sections where information is readily available**). This will assist in repeating successful techniques in the future and will provide a log of techniques that have been applied.

Other sections:

3. Ditch blocking
4. Surface smoothing
5. Bare peat - mulch
6. Bare peat - stabilisation
7. Bare peat - seed, plug, sphagnum

1. Dates

Restoration Start Date (yyyy-mm-dd)	
Restoration Finish Date (yyyy-mm-dd)	

2. Photos

Site	6 figure grid reference	Photo ID	Description	Reason	Date	Stage
Site ID as given in Q8	Where available, provide a grid reference from where photo was taken (recorded directly from GPS)	Image file name or number	Description of what is seen in the photo	Reason for photo (eg restoration technique, feature of interest, condition)	Date photo taken (yyyyy-mm-dd)	Stage of restoration (e.g. before, during, after)

3. Ditch blocking – provide details of each type of dam used in your project

Please use one line for each **type** of dam used.

Site ID	Standard peat dam	Wave peat dam	Plastic dam	Wood dam	Stone dam	Heather bales	Size - a
as given in Q8	number	number	number	number	number	number	dam wid

4. Surface smoothing – please provide details of surface smoothing used in your project

Site ID	Technique	Area	Previous forest crop, if any	Date of felling
as given in Q8	e.g. stump flipping/cross tracking	ha	Species	Year

5. Bare peat mulch – provide details of mulch/ mix used in your project

Site ID	Mulch / Mix ID	Composition	Percentage of mulch/mix	Average size of mulch pieces (cm)	Total average depth (cm)
as given in Q8	Provide an identity for each type of mulch used	Composition of mulch. Where a mix is used, use one line for each component of the mix	Percentage of each component of the mix– the total should add up to 100 for each mulch/mix type	For example, the average length of the heather/spruce or brash pieces	

6. Bare peat – stabilisation

Site ID	Stabilisation material	Geo textile mesh size	Total area covered by geotextile
as given in Q8	e.g. Hessian mesh	(mm)	(m)

7. Bare peat – provide details of seed/plug/sphagnum used in your project

ID	Seed composition type	Seed composition percentage	Plug plant	Plug plant type	Sphagnum – beads, plugs, translocation	Sphagnum source	Fertiliser	Ratio of N:P:K
Provide an identity for each treatment	Species of seed used	Total should add up to 100 for each treatment	Y/N	Species of plug plant	beads/plugs/ translocation	Grid ref of site or supplier	Y/N	x:x:x

END OF REPORT

Appendix B

Methods

The research draws on two main data sources and relies largely on qualitative data analysis.

The first data source comprises information provided by Peatland Action recipients as part of the final reporting process, drawing on a sub-set of recipients that formed the basis of an earlier analysis on restoration costs[11]. This included 90 unique projects covering 194 restoration sites. A subset comprising 46 (out of 90) of the final report forms are included in the analysis. The information reported on the final reporting forms included an introduction to the restoration project's goals and mission, the basic features of the sites, legacy and site/restoration history and challenges to overcome as well as perceived benefits of restoration.

The second data source are 5 semi-structured interviews, conducted remotely, with key stakeholders (Table A1) who provided a wider perspective on the experiences and challenges with peatland restoration, in particular regarding the main barriers to engage land managers and crofters on restoration and what would be key actions that may improve engagement. This research was approved by SRUC's ethics committee prior to data collection and verbal prior informed consent was obtained from research participants.

Table B1: Interview participant affiliations

Participant code	Affiliation
I1.1	Farming sector representative organisation
I1.2	Farming sector representative organisation
I2	Farming sector representative organisation
I3	Independent consultant
I4	Private estate representative
I5	Farming sector representative organisation

All qualitative data were imported into NVivo software to provide a common platform for qualitative data coding. A grounded theory approach was used for coding. As such, an initial codebook was developed to guide the initial coding while also allowing for emergent codes.

In addition, as part of the final reporting process, respondents included sections referring to 'monitoring information'. These include a series of closed-ended questions asking for basic information on applicants (e.g. size of land holding) and their main views and motivations for undertaking peatland restoration. Similar closed-ended information was collected as part of the final reporting on Peatland Action grantees' experience, including on e.g. perceived changes and benefits. This mainly quantitative data was entered into a data base, cleaned (i.e., checked for systematic errors in reporting and data entry), and then summarised using descriptive statistics. The main aim of this analysis is an

overview of motivations and perceptions around restoration among Peatland Action grantees.

In the points below, we summarise the key themes gathered through the analysis of the reporting forms and interviews regarding perceptions and attitudes of individuals and organisations with respect to peatland restoration:

- Motivations to engage in peatland restoration
- Changes – both positive and negative – that result from peatland restoration
- Challenges experienced in peatland restoration projects and the steps taken to overcome them
- The role of community engagement and partnerships
- The relative value of funding support and processes for application

The analysis here will reflect mainly the experiences gathered so far through the Peatland Action programme. While Peatland Action has been a main source of funding for peatland restoration and therefore a significant source of information, it is not an exhaustive account of all peatland restoration taking place in Scotland. It also doesn't include information about those who have withdrawn from the programme and the reasons to do so. In this regard, the qualitative interviews fill some of these gaps beyond Peatland Action.

In addition, access to some of these data has been through Freedom Of Information and in other cases it may be commercially sensitive (e.g. from hydro schemes). In that respect, none of the reviewed projects referred to a systematic monitoring of restoration impacts.

Appendix C

Codebook used in NVivo – themes discussion in the text are drawn from this analysis.

Barriers to restoration
Benefits from peatland incompatible with restoration
Capacity
Cultural
Cultural barriers
Domino effect
Funding - application process
Funding - rules and guidance
Knowledge
Knowledge of benefits
Knowledge of implications
Knowledge of peatland degradation
Knowledge of restoration process
Knowledge of the scheme
Post-project commitments
Relationship with NatureScot
Reversal of prior land management
Scale
Benefits

Environmental benefits
Positive effects on business or organisation
Socioeconomic benefits
Challenges
Challenges during restoration activities
Challenges with grant process
Environmental challenges
Funding access, availability
Disbenefits
Environmental disbenefits
Negative effects on business or organisation
Socioeconomic disbenefits
Engagement
Land manager engagement
Partnership
Wider community engagement
History of the site
Incentives to restore
Lead Organisation
Council
Croft

- Environmental NGO
- Estate
- Farmer
- Forestry company
- Landowners
- Lessons learned
- Negative experiences with grant process
- Positive experiences with grant process
- Restoration goals
  - Biodiversity
  - Business benefits
  - Climate change
    - Image
    - Normative
  - Normative
- Restoration works
- Room for improvement
  - Improving grant process and restoration process
  - Improving uptake
- Scale (operations)
- Site characteristics

Croft
Current management and use
Highlands
Islands
Lowlands
Peatland type
Uplands
Urban

Appendix D

Applicants to Peatland Action's funding were also asked to rate 14 pre-identified reasons as "Very important", "Somewhat important" and "Not important at all" for engaging in peatland restoration. The possible motivations were:

- Improved access to the land (M1)
- Reduced mortality of livestock & grouse chicks (M2)
- Improved conditions for biodiversity (M3)
- Improved water quality (M4)
- Improved fisheries (M5)
- Reduced need for controlled burning (M6)
- Reduced carbon footprint of land holding/own business (M7)
- Water catchment management (M8)
- Flood risk reduction (M9)
- Maintain a good public image (M10)
- Potential for access to carbon or off-set markets (M11)
- Be prepared for future regulation on peatlands (M12)
- Promote other business activities (M13)
- Other reason (M14)

Figure D1 shows how applicants rated these motivations. It is apparent that **improving conditions for biodiversity** (M3), **reducing carbon footprint** (M7) and **improving quality of water** (M4) have received the highest ratings overall.

Among the motivations that appeared the least popular, there are the reduced need for controlled burning (M6), the potential access to carbon markets (M11), reducing the mortality of livestock (M2) and improving access to land (M1). In particular, the relatively low score of carbon markets (M11) compared to the relatively high score of carbon footprint reduction (M7) is in line with what was noted from the interviews, namely the importance of normative reasons to engage in restoration.

Note that, as shown by the number of responses, the two "other" reasons (M13 and M14) have been ticked by participants only occasionally; therefore, their shares should not be directly compared to those of other motivations.

Figure D1: Participants' rating of motivations to engage with peatland restoration

Motivations that have been cited to specify the "Promote other business activities" option (M13) include:

- Tourism and farm brand
- Marketing native Shetland lamb
- Purposes related to golf club management

Motivations that have been cited as "Other reason" (M14) include:

- Promoting the value of peatlands
- Restore grazing capability
- Mitigate damage done in previous decades by hill drains
- Learn aspects of peatland restoration and its effects on hill sheep grazing
- To restore the landscape to conditions prior to human interventions

- Promote peatland restoration in the region

In addition to ratings, applicants completing PA forms have been asked to rank the three most important motivations for engaging in peatland restoration. The most popular motivations (i.e. the ones that were often ranked on 1st, 2nd or 3rd positions) were: improved conditions for biodiversity, improved water quality and reduced carbon footprint. Figure D2 shows the outcome of participants' ranking.

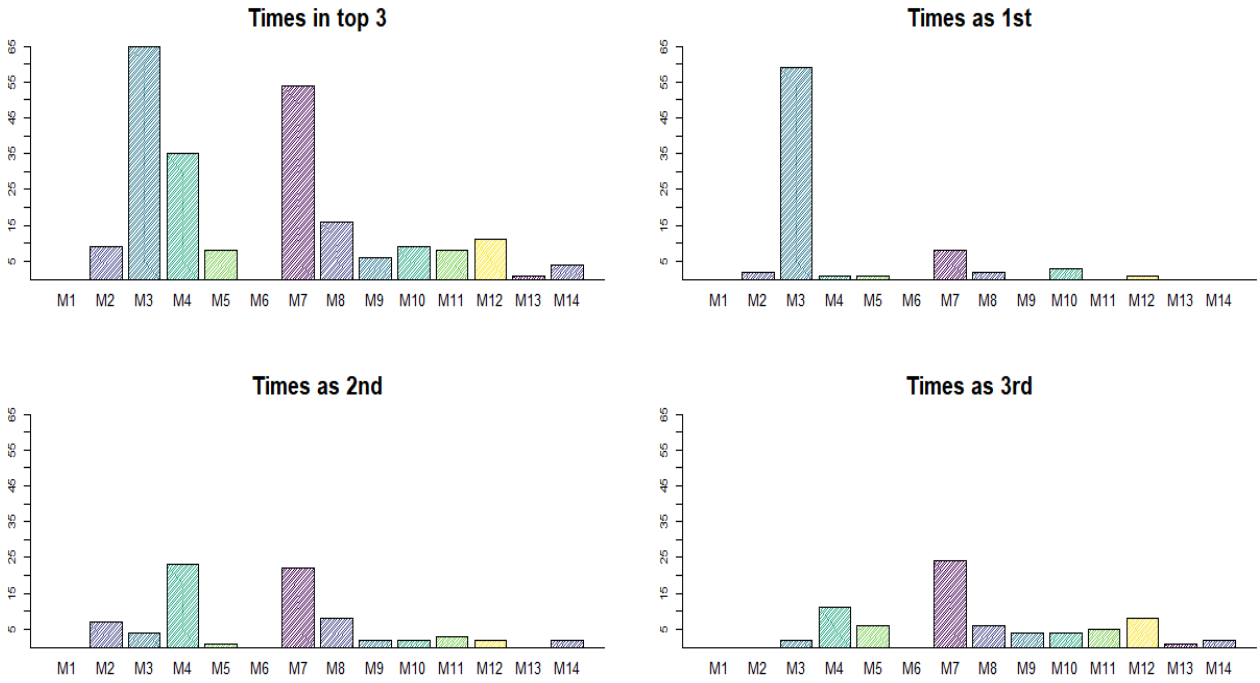

Figure D2: Participants' ranking of the three most important motivations

Appendix E

PA forms asked applicants to rate (from “not important” to “very important”) six actions that may be used to encourage other land managers to become engaged with peatland restoration. These are:

- Provide better/more information on the impacts of restoration (A1).
- More awareness raising / training events (A2).
- Facilitate application process (A3).
- Guarantee of no loss of single farm payment (or post-Brexit equivalent) (A4).
- Provide means of funding up-front costs (A5).
- Include peatland maintenance/management payments in future agri-environment schemes (A6).

Figure E1 shows how applicants rated these actions. Overall, it appears that there is a good level of consistency in deeming all actions important. The actions that were consider sightly more important are: A3, A4 and A5.

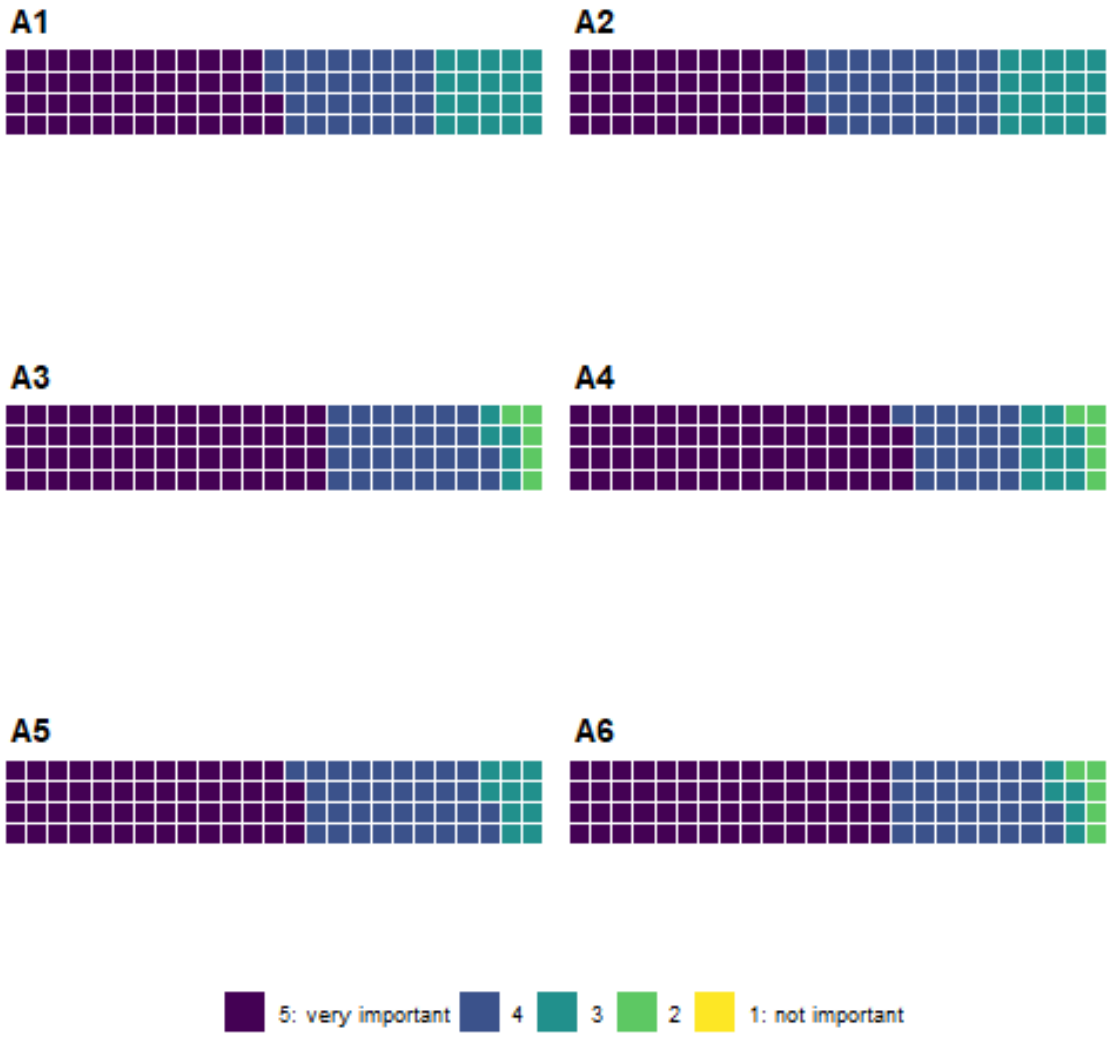

Figure E1: Participants’ rating of actions to engage other land managers

In addition to rating, some of the applicants have been asked to rank the three most important actions among the ones discussed above. Figure D2 shows how many times each of the actions was included among the three most important ones, and how many times it was identified as the first, second or third most important: overall, providing **better/more information** (A1) and providing means of **funding up-front costs** (A5) stand out as the most relevant actions needed to convince more land managers to carry out funded peatland restoration.

The importance of A1 is consistent with what has been noted in the main text about closing the knowledge gap regarding what peatland restoration is, what benefits it can contribute and what it entails in terms of land management.

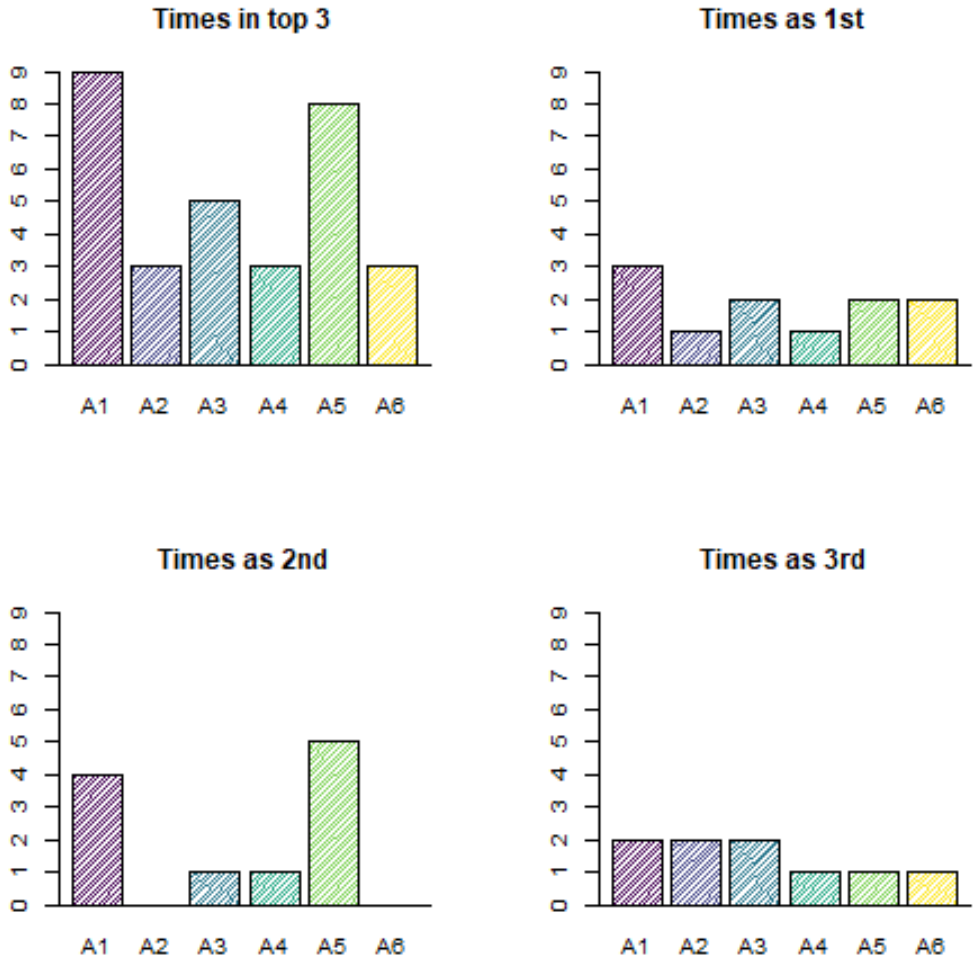

Figure E2: Participants' ranking of the three most important actions

Appendix F

Summary findings: Strengths, weaknesses, opportunities and threats (SWOT) of peatland restoration in Scotland.

<table>
<tr><th>Strengths</th><th>Weaknesses</th></tr>
<tr><td>Delivers multiple environmental and social benefits (carbon, biodiversity, water regulation, employment, etc.).
Demonstrates good land stewardship.
Improves public perception of farming.
Provides opportunities for peer-to-peer learning.
Early engagement with landowners facilitates restoration.
Embedding PA officers in other organisations facilitates building-up connections and engagement.
Funding of up-front costs.</td><td>Wider impacts on perceptions of how land is managed.
Impact on eligibility for farming payments or governmental tax breaks.
Temporary cashflow problems.
Tight timings to deliver the project over winter months.
Cultural clashes from loss of historical and cultural values.
Potential negative public perceptions of tree removals.
Ease of restoration logistics contingent on environmental conditions.</td></tr>
<tr><th>Opportunities</th><th>Threats</th></tr>
<tr><td>Wider promotion of benefits from restoration and support
Target promotion efforts and engagement with smaller landowners, such as crofters.
Neighbours can help the spread of peatland restoration with peer-to-peer learning on the experience of restoration.
Conduct systematic monitoring of restoration impacts.
Recognise historical good practice in land (peatland) management.
Consider farm and land-based cycles for funding scheduling.
Develop a pooling or shared hire system of specialist equipment.
Include training in the use of specialist equipment.
Include peatland maintenance/management in future agri-environmental schemes.</td><td>To uptake:
Complexity of application process and funding mechanism.
Lack of knowledge of the benefits or the process of restoration.
Differing views on what is considered ‘degraded peatland’.
To outcomes:
Not being able to secure multi-year funding for significant restoration efforts.
Inconsistency in guidance regarding use of peatlands.
Poor communication between different partners (e.g. contractors, land managers, estate factors, PA officer, etc.).
Partnerships can bring clashes between visions and objectives.</td></tr>
</table>

Summary findings: political, economic, social, technological, environmental and legal analysis (PESTEL) of peatland restoration in Scotland.

	Opportunities	Constraints	Potential mitigation measures
Political	• Helps Scottish Government meet climate targets	• Challenges understanding the application process and funding mechanism • Application and reporting material being daunting • Inconsistency in guidance regarding the use of peatlands	• Facilitation through advice services • Integrate peatland restoration in farm payments / agri-environment schemes
Economic	• Reduces the impact of peatland degradation on human-made infrastructure • Improves access to the site which could ease future management • Employment of local contractors and training opportunities • Potential reduction in chick mortality and stock losses in ditches	• Limited knowledge of the benefits and support available • Impacts on how land is managed • Impact on eligibility for farm payments or government tax breaks • Funding only available on a yearly basis • More challenging for smaller landowners to engage in restoration • Delays in funding approval • Temporary cashflow problems • Tight timing of projects over winter months	• Improved communication and advice on benefits and support available • Establish multi-year funding • Consider farm and land-based cycles for funding scheduling
Social	• Contributes to aesthetical improvement of the landscape • Could flood risks and water treatment costs	• Communication and cooperation challenges • Cultural clashes as restoration could undermine cultural and historical values	• Provide means to support partnerships • Embedding PA officers in organisations facilitates engagement

	• Could improve the image and public perception of farming Enables land managers to show good stewardship of the land • Opportunities for learning • Neighbours can play a key role in the spread of restoration	• Negative public perception linked to tree removal as part of restoration actions	
Technological	• Reduction of water runoff and sediments	• Availability of contractors • Skills to manage specialised equipment	• Pooling or shared hire system of specialist equipment • Training on use of specialist equipment
Environmental	• Improves water holding capacity and, in turn, reduces runoff and slows down water flows • Prevents further peat erosion and retention of existing carbon stores • Habitat improvement through re-vegetation	• Weather and site conditions can impact on restoration timing and logistics	
Legal		• Confusion on eligibility for farm payments or governmental tax breaks. • Re-classification of peatlands from/to agricultural land.	• Clear communication on interaction between different rules. • Consider joined up regulations.

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