Harper Adams University

Restoring Lowland Peatland for Biodiversity & Carbon:

Lessons from the Meres and Mosses

Proceedings of the 1-day conference sponsored by the Marches Mosses BogLIFE Project

Wednesday 20th July 2022

Editors

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Restoring Marches Mosses BogLIFE Project (LIFE15 NAT/UK/000786)

Life | NATURAL ENGLAND | Cyfoeth Naturiol Cymru Natural Resources Wales | NATURA 2000 | CRONFA DREFTADAETH HERITAGE FUND | Shropshire Wildlife Trust

Whixall Moss (Stephen Barlow, 2019)

We would like to thank the following people and organisations without whom/which this conference would not have been possible: Shropshire Wildlife Trust (Richard Grindle, CEO, Helen Trotman, Joe Phillips, Jordan Davies, Pete Lambert and Cath Edwards) and Robert Duff of Natural England for working together to deliver the tender for this conference. We would also like to thank Harper Adams University, especially Julia Casperd, Simon Jeffery and Lisa Plant for organising and hosting the conference; the speakers: Professor Fred Worral (University of Durham), Dr Chris Field (MMU); Renee Kerkvliet-Hermans (The Peatland Code); Kate Mayne and Dr Neil Brown (North Shropshire Farmers; Scott Kirby (Harper Adams University, Future Farm Manager); and the delegates from across the farming community and within conservation for attending and contributing to the workshops. Finally, we would like to thank the funders of the Restoring the Marches Mosses BogLIFE Project (LIFE 15 NAT/UK/000786); The National Lottery Heritage Fund; EU Life; Natural England; Cyfoeth Naturiol Cymru/Natural Resources Wales and Shropshire Wildlife Trust.

Executive Summary

Dissemination, and the transfer and exchange of knowledge regarding peatland restoration has never been more important. The end of the Marches Mosses BogLIFE Project provided a timely opportunity for Harper Adams to engage and open up the conversation between farmers, environmental land managers, financial institutions and conservation organisations in support of the restoration of the variety of lowland peatlands found across the Meres and Mosses landscape. We were delighted to be able to work closely with project staff and Shropshire Wildlife Trust to design a programme of talks which would report on the significant achievements of the BogLIFE Project but also explore best practices of lowland peatland restoration for carbon and local nature recovery (biodiversity).

Figure 1 Word cloud generated at the beginning of the conference showing which organisations delegates represented.

It was clear at the point of advertising in June 2022, that this was to be an important conference. Uptake of places was swift from a broad range of organisations (see Figure 1 and Appendices 4 & 5). A total of 59 delegates (21 online and 38 face to face) attended this hybrid conference. Including the speakers and conference organisers (N=11) there was a total attendance of 70 people. The reasons for attending the conference were many and varied which are represented by the word cloud in Figure 2. Attendees wished to gain a better understanding of the key considerations in restoring lowland peatland, particularly from previously high-grade agricultural land and to explore the opportunities for paludiculture. They also sought to gain knowledge regarding the measurement of different ecosystem services relating to carbon store protection and sequestration and biodiversity in general but also for the purposes of Biodiversity Net Gain (see also Appendices 4 & 5).

A planned field visit by delegates to the Marches Mosses BogLIFE Project planned for the 19th of July was unfortunately cancelled by Natural England due extreme hot weather.

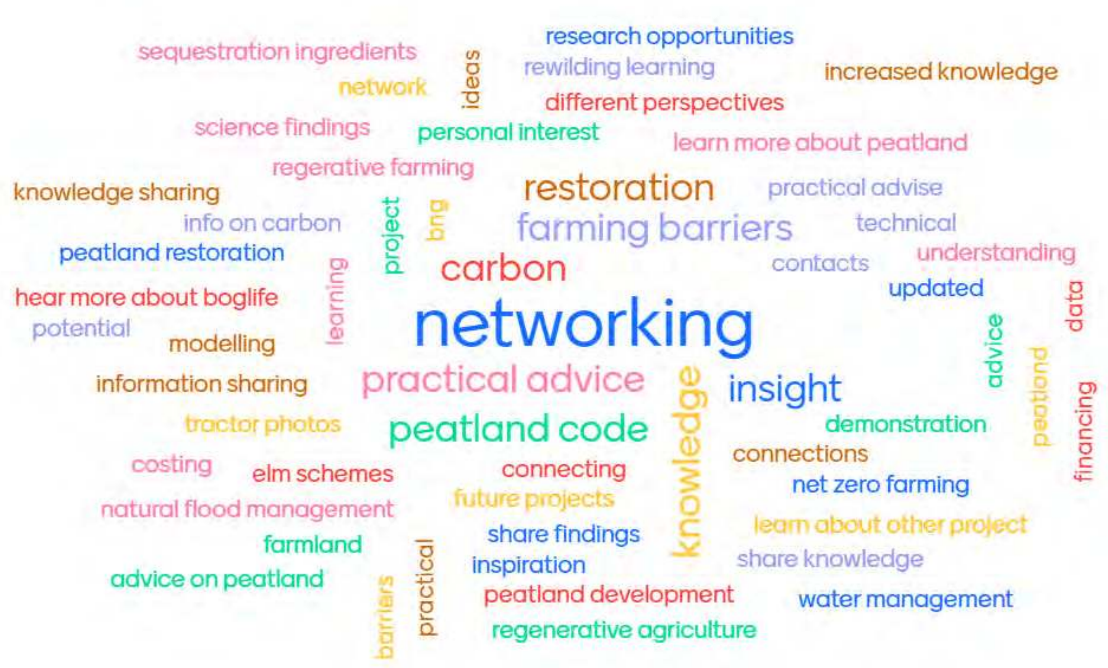

Figure 2 Word cloud showing what delegates hoped to get out of the conference.

Life
NATURAL ENGLAND
Cyfoeth Naturiol Cymru Natural Resources Wales
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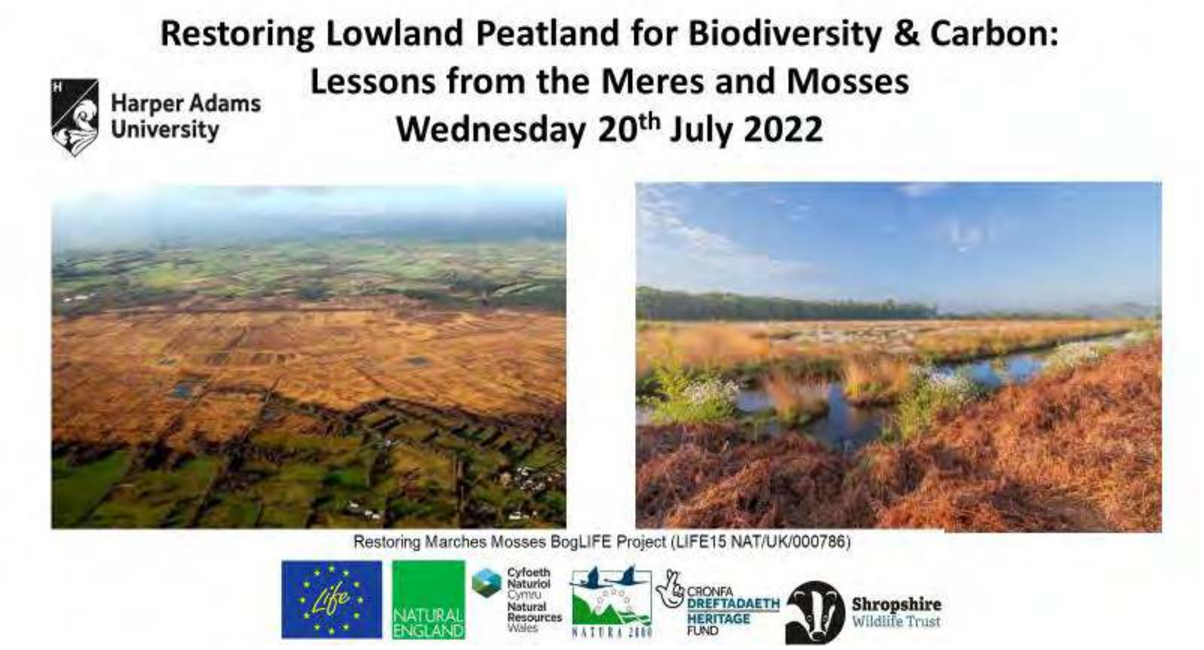
Shropshire Wildlife Trust

Contents

Fenns and Whixall Mosses NNR (Shropshire Wildlife Trust)

1.0 Introduction

It was apt that this conference was hosted by Harper Adams University not only for its locality (in Shropshire) and proximity to the Marches Mosses, which are part of the Meres and Mosses landscape, but also because the university's Future Farm and campus sit on pockets of ancient lowland peatland which were laid down beneath the mere which used to cover the Weald Moors in the last ice age. Drainage of the land in the nineteenth century allowed for the expansion and intensification of agricultural practices. The soil, rich in organic carbon, was ideal for the production of high value crops. However, with the advent of more regenerative agricultural practices and the desire to achieve carbon Net Zero, the protection of these lowland peatland areas has come under increasing scrutiny. As the UK rallies to mitigate the effects of climate change, how may these carbon stores be protected from further degradation, whilst continuing to be farmed providing an income for the farmers of the county? In addition to this, how can farmers sequester carbon during this restorative process, thus offsetting carbon emissions from their farms and potentially providing a source of carbon credits? These common questions that farmers of lowland peatland across the UK are asking themselves, are in fact the self-same questions we here at Harper Adams University are asking ourselves, as we journey towards carbon Net Zero by 2030 and a more sustainable future across the farm and campus. Harper Adams University, historically an agricultural college has responded to government policy and driven the intensification of farming in order to optimise productivity. As a world leading university in this area, informing agricultural practise, it now must show best practise in the farming of this type of soil. Disseminating the results of the Marches Mosses BogLIFE Project via this conference has provided Harper with the opportunity to open up conversations between farmers and conservation organisations, and to build networks, to explore different ways of restoring lowland peatlands and how this process may be baselined and monitored with a view to informing on the best regenerative practises for carbon and biodiversity.



2.0 Abstracts

Restoring Marches Mosses BogLIFE Project (LIFE15 NAT/UK/000786)

2.1 'The Peatland Code' Dr Renee Kerkvliet-Hermans, IUCN.

The Peatland Code is the only UK Government-backed standard way to measure, validate and verify peatland carbon units in the UK. By using the Peatland Code, a landowner can receive private financial investment through the sale of carbon units (carbon finance). Money from the sale of carbon units does not replace existing finance mechanisms including public funding, philanthropic giving, or corporate social responsibility payments. Under the Peatland Code a project can be entirely funded through carbon finance or blended with public funding sources, including agriculture support. The amount of carbon finance needed will vary depending on the level of alternative funding available, the condition of the peatland, the type of restoration needed, and the long-term management requirements of the site.

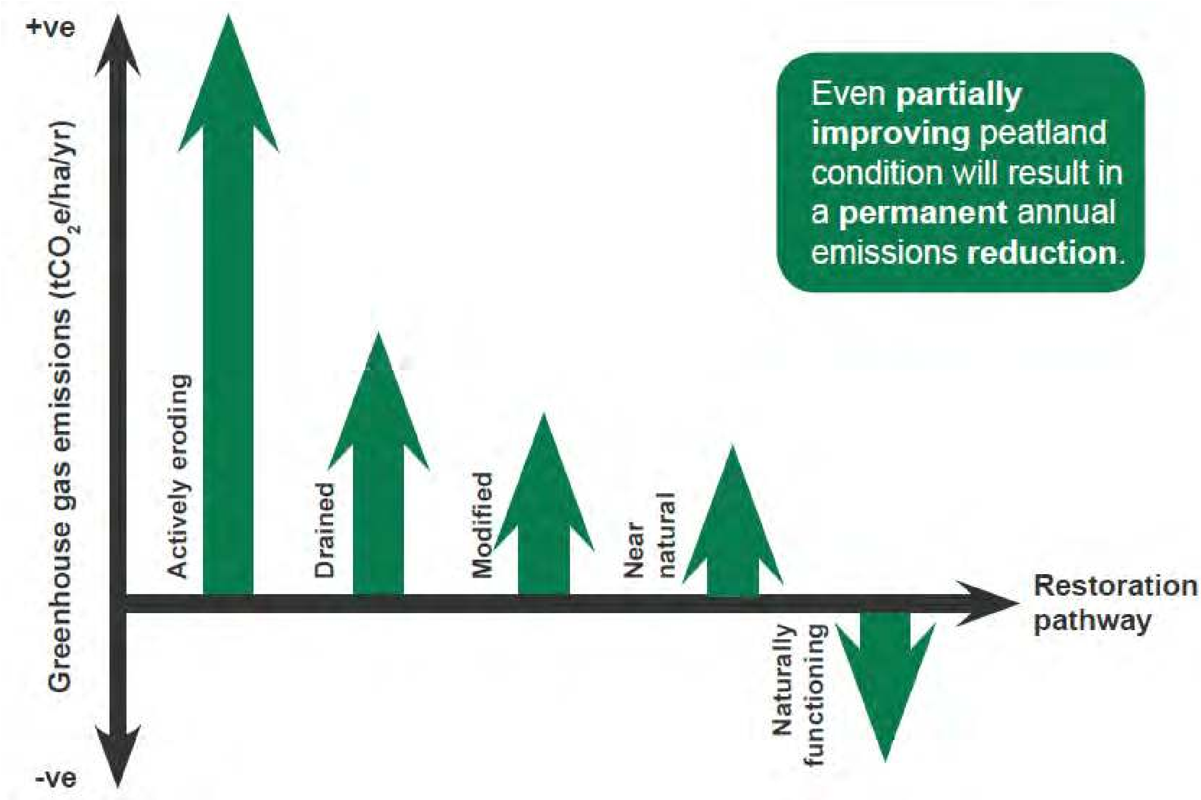


Figure 3.0 The relationship between peatland restoration pathway and greenhouse gas emissions.

2.2 'Barriers to Regenerative Agriculture'

Scott Kirby (Harper Adams University, Future Farm Manager)

Regenerative Agriculture may be defined as a farming system which harnesses natural processes to improve the health of the soil in terms of its ecosystem services. Although this practice is soil focused, it also maintains healthy plants, animals and people. These ecosystem services include: 1. provisioning (e.g. food, clean water); 2. regulating (e.g. climate, water, erosion and nutrient utilisation/efficiency); and 3. supporting (e.g. soil formation, photosynthesis and nutrient cycling). Regenerative Agriculture has the potential to deliver much more than a farming system. It has 5 key principles: A. maintaining cropping diversity; B. protecting the soil surface and maintaining soil mycorrhiza with an overwintering armour of cover crops; C. integrating livestock; D. minimising soil disturbance using no-till methods; and E. maintaining soil life, integrity and living roots. It differs from sustainable agriculture, which seeks to maintain the farming status quo by meeting the needs of the current population (economically, socially and environmentally) without compromising the needs of the future generations. Sustainable Agriculture is not always regenerative but Regenerative Agriculture is always sustainable. The main barriers to Regenerative Agriculture are a lack of knowledge (see Figure 5.0) and financial risk (Table 1.0), e.g. in lowland peatland Regenerative Agriculture systems would currently focus on low value crops. Other barriers include: time, labour, lack of equipment, uncertainty surrounding ELMS and a perceived lack of value within carbon audits (see Figure 4.0 & 5.0).

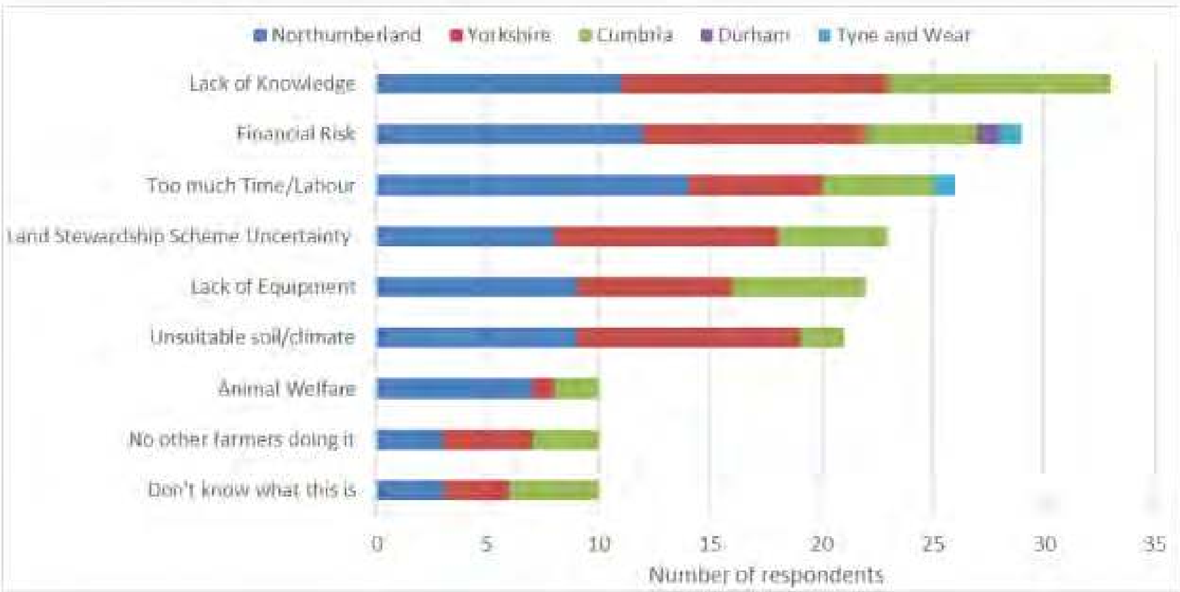


Figure 4.0 Farmer responses selecting barriers to adoption of regenerative agriculture in the North of England, taken from Magistrali et al. (2022).

Regenerative Agriculture is a knowledge intense system which is currently undermined firstly by the availability of appropriate research funding to support the longitudinal studies necessary to track the changes which occur in RA systems; and secondly by the cultural barriers to knowledge transfer among the farming community. Farmers are influenced by what other farmers are doing and their learning is quite often peer to peer; and informed by social media rather than research led. In addition to this, research into Regenerative Agriculture requires reduced resources, reduced equipment and more time; and quite often a loss of productivity is evidenced before there is an increase. As such it does not attract industry partners to drive blended finance. In order to accelerate Regenerative Agriculture in support of the restoration of lowland peatland for carbon and biodiversity; it is crucial, therefore, that there is collaboration between regenerative farmers and environmental sectors to drive technological advancements and knowledge transfer, thus encouraging investment by government and industry.

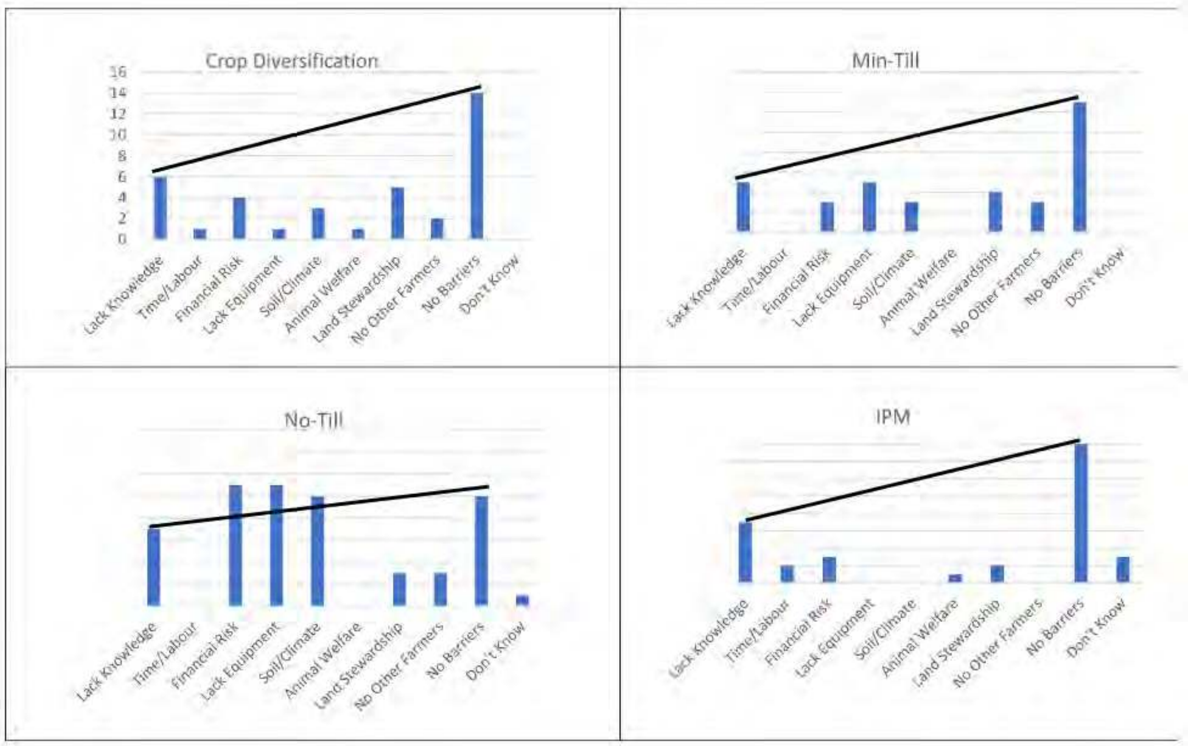


Figure 5.0 Online survey responses - barriers to regenerative agriculture – the need to share knowledge, taken from Magistrali et al., 2022.

Farm Type	Medium Lowland Dairy Farm	Medium Cereals Farm	Medium LFA Livestock Farm	Medium Lowland Mixed Farm
Farm area - hectares	£80	£292	£144	£137
Crop & Livestock income	£211,678	£302,574	£87,905	£169,174
Other income	£30,271	£136,032	£21,707	£64,266
Agri-environment & BPS income	£23,153	£77,001	£41,840	£38,298
Total Income	£265,102	£515,607	£151,452	£271,738
Variable costs & valuation changes	£94,334	£150,748	£47,526	£100,906
Gross Profit	£170,768	£364,859	£103,926	£170,832
Overhead Costs	£100,277	£203,386	£47,584	£91,252
Depreciation	£24,923	£66,569	£14,053	£27,861
Total Overhead Costs	£125,200	£269,955	£61,637	£119,113
Net Profit	**£45,568**	**£94,904**	**£42,289**	**£51,719**
% profit from subsidies	**5**	**8**	**98**	**74**
Profit excl. Subsidies	**£22,415**	**£17,903**	**£449**	**£13,421**

Table 1.0 Data extracted from DEFRA's Farm Business Survey demonstrating costs of different farm types and associated net profit (including & excluding subsidies) England (DEFRA, 2020/21)

References

DEFRA (2020-21) Farm Business Survey, England 2020/21. Available at: https://www.farmbusinesssurvey.co.uk/regional/ (accessed 28th August 2022).

Magistrali, A., Cooper, J., Franks, J., George, D. and Standen, J. (2022). Identifying and implementing regenerative agriculture practices in challenging environments: experiences of farmers in the north of England. Available at: https://projectblue.blob.core.windows.net/media/default/researchpapers/ahdb/2022/pr640-09finalreportahdb-bbsrcfarmsustainabilityfund(cooper).pdf (accessed: 28th August, 2022).

2.3 'Peatland restoration opportunities and challenges – the landowners' perspective'

Dr Neil Brown (Bentley Farm) and Kate Mayne (North Shropshire Farmers Group).

The peatlands of North Shropshire are part of the unique Meres & Mosses landscape. Our peat bodies are relatively small and typically do not produce the high value cash crops produced from fens in areas like Cambridgeshire. This makes them potentially more suited to restoration.

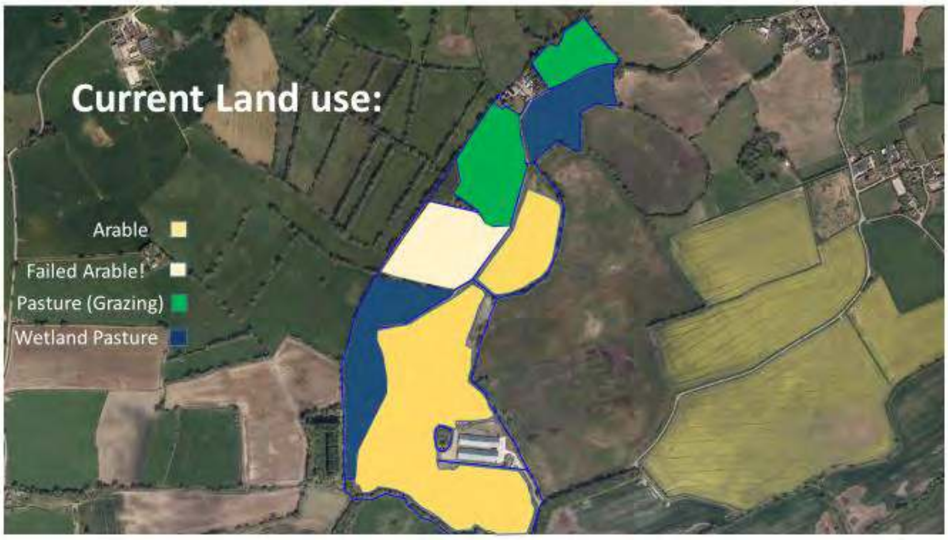


Figure 6.0 Map showing the current land use on Bentley Farm.

They are however set in amongst productive farmland which commands high purchase and rental values. As a result, convincing farmers to take their peatland areas out of primary farming activity can be challenging. In larger hydrological cells peat restoration can stall due to the impacts that rewetting may have on neighbouring land, and many of the smaller peat bodies are not mapped or are considered too small on their own for high tier funding.

Farmers have many different motivations for restoring peat, depending on their farming system, income, family, property ownership etc. Farmers need a guaranteed income stream from peatland, at a competitive rate, for longer than the 10 years to make restoration attractive. Recognising public goods delivery and putting suitable incentives in place is key.

From a practical perspective, farmers need ongoing support and advice when rewetting peat. There is a lot of uncertainty about what the wetted peat areas should look like and what management is required. Farmers need flexibility in the system to use their own knowledge and experience of the land to deliver the target habitat type. There is much concern about long term funding for peatlands; once restored how will it affect the viability of the farm, will incentives remain longer term, and how will farmers be compensated - through carbon markets, biodiversity net gain, local nature recovery?

Figure 7.0 Image indicating potential sites for wetland farming on Bentley Farm.

2.4 ‘Carbon modelling at Whixall Moss’ Professor Fred Worrall,

Dept of Earth Sciences, University of Durham.

This study considered both the carbon stock and contemporary carbon and greenhouse gas budgets of the Fenns and Whixall Mosses. The study used local information for the carbon stock assessment and the Durham Carbon Model for the budget assessment. The carbon and greenhouse gas budgets were assessed relative to cessation of peat extraction; the LIFE project restoration; and management for optimised greenhouse gas budget.

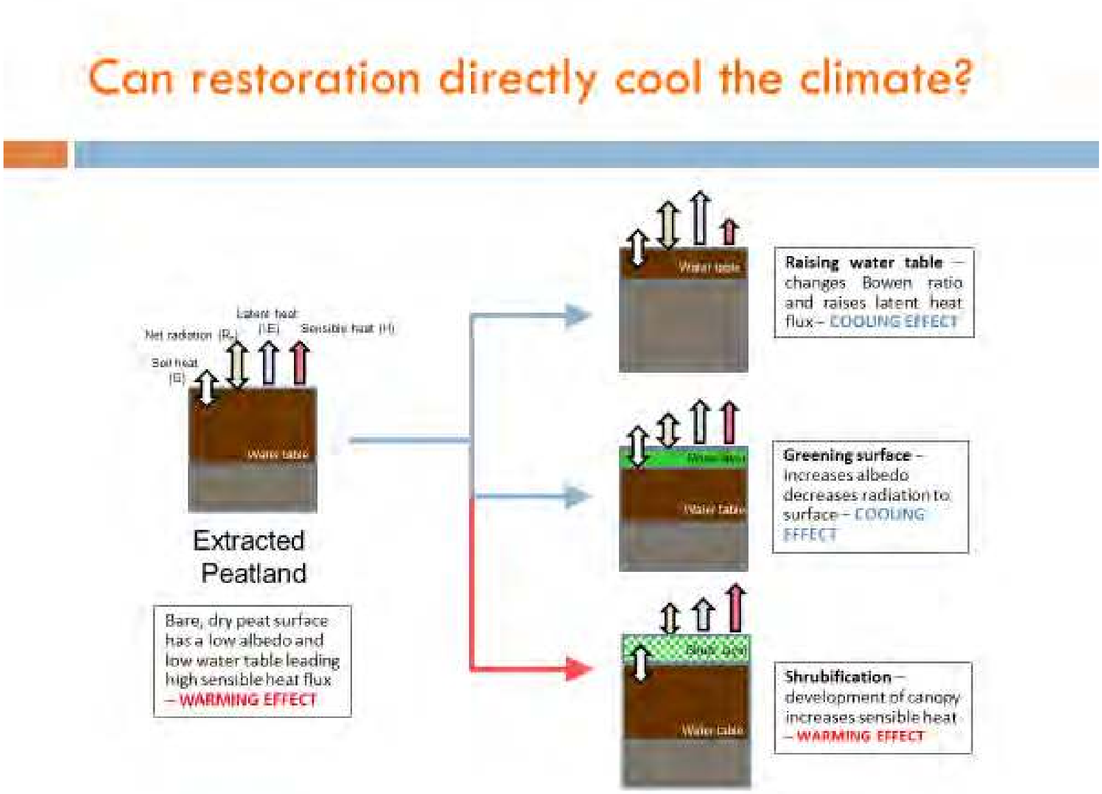


Figure 8.0 Infographic illustrating the effect of different peatland restorative practices on the climate.

The study has shown:

- The amount of carbon stored in the Fenn’s and Whixall Mosses is estimated to be 1183 ± 99 ktonnes C – this is equivalent to annual greenhouse gas emissions of just over 4 million UK citizens.
- The Fenn’s and Whixall Mosses were a net sink of both C and greenhouse gases prior to LIFE project restoration with an estimated sink size of -4.2 ktonnes CO_{2eq}/yr.
- The LIFE did enhance the magnitude of both C and GHG sinks across the Fenn’s and Whixall Mosses with an estimated sink size of -4.3 ktonnes CO_{2eq}/yr.

- Further improvements in the magnitude of the greenhouse sink on Fenn's and Whixall by further development of sphagnum mosses - estimated sink size of -5.2 ktonnes CO_{2eq}/yr – this is the annual emissions of almost 1000 UK citizens.
- Relative to the period after the cessation of peat the extraction, the carbon and greenhouse gas budget of the current Mosses after the LIFE restoration project was a saving of 197 tonnes C/km^2/yr, or 685 tonnes CO_{2eq}/km^2/yr.
- The capacity for further storage is vast, estimated at 7 Mtonnes CO_{2eq}, although to realise this potential, techniques for enhanced carbon storage on the Mosses would be required.
- The carbon storage on the Mosses could now be monitored remotely through Earth observation.

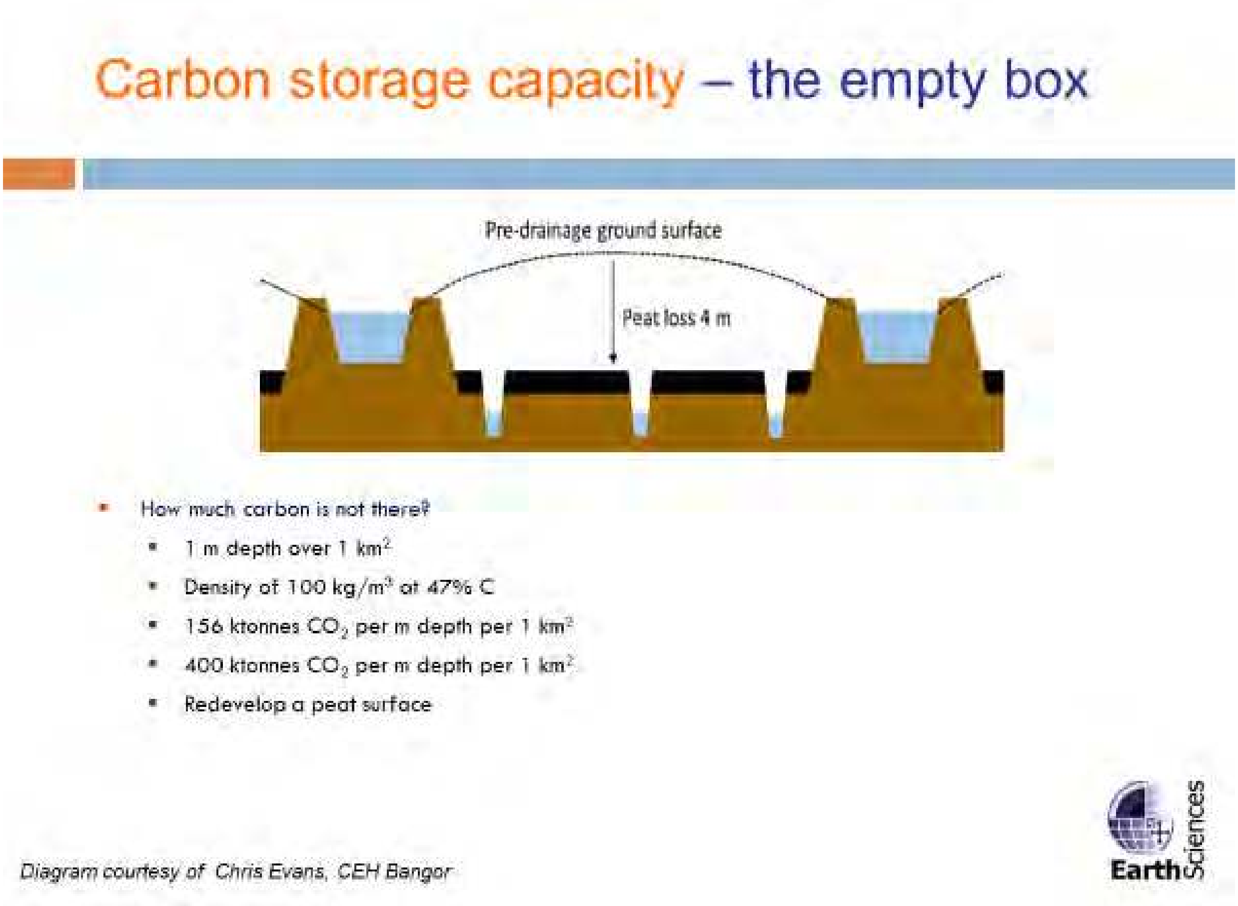


Figure 9.0 Infographic illustrating the carbon storage capacity of lowland peatland.

2.5 'Winmarleigh Carbon Farm: Experimental set-up, GHG analysis and first year carbon budgets'

Chris Field[1], Anna Keightley[1], Simon Caporn[1], Mike Longden[2], Sarah Johnson[2], Jo Kennedy[2].

[1]Manchester Metropolitan University, [2]Lancashire Wildlife Trust.

Drained agricultural peatlands are a source of 20% of sector GHG emissions and are unsustainable over the longer-term. Alternative land management that can reduce emissions, sequester carbon and provide an income for landowners are needed. As part of the EU funded Care-Peat project we established a Carbon Farm on a former lowland raised bog that was drained and converted to agricultural grazing land in the 1970s. The objective was to rapidly turn the site from a carbon source to a carbon sink through dense planting of *Sphagnum* moss and raising the water table.

Peat cores showed that carbon (C) stored measured approximately 692 tonnes C ha^{-1} over around 1.5 metres of peat. Preliminary study of surface peat showed oxidation from 50% to 40% carbon, high levels of farming nutrients and elevated calcium and pH. The upper 10 cm surface of peat was stripped to reduce these effects, remove grass roots and seed bank and the displaced peat was used to block ditches, create bunds and block layered drainage. The 100 m by 200 m site is divided into 8 cells, each 50 x 50 m. Irrigation of these cells is via channels fed from a sump, automatically pumped, controlled and solar-powered with the aim of maintaining a water table of 10 cm below the surface, the suggested optimum for reducing GHG emissions. Six cells were planted with 150,000 micropropagated BeadaHumok™ in September 2020 with two final cells planted with Common Reed (*Phragmites australis*) to clean irrigation water before it re-enters the natural water course.

Figure 10.0 The process of reversion from grazed pasture to a 'carbon farm'.

GHG monitoring collars and dipwells were installed on the Carbon Farm and an adjacent drained, grazed pasture as a control site. A weather station was installed to monitor environmental conditions and enable modelling of the annual carbon balance. First year Sphagnum growth in GHG collars increased from 4.5% cover on planting in September 2020 to 24% in August 2021. Monthly Net Ecosystem Exchange (NEE) showed strong uptake of CO_2 in the grazed pasture during daylight measurements but strong respiration losses also. In contrast the Carbon Farm showed negligible respiratory losses and chamber NEE was in approximate equilibrium, shifting to a small uptake towards the end of the first 12 months. When modelled using environmental data the grazed pasture revealed a CO_2 loss of 24.4 tonnes CO_2 eq ha^{-1} yr^{-1}, compared to a much smaller loss of 3.4 tonnes CO_2 eq ha^{-1} yr^{-1} on the Carbon Farm. Methane emissions for both pasture or carbon farm were negligible. Based on the current rate of carbon losses, the site could experience complete peat loss over the next 104 years.

Results so far demonstrate that rewetting a drained peatland reduces CO_2 losses by 86% in the first year, with a sink predicted to form as *Sphagnum* cover increases. The pilot highlights opportunity for alternative land use, potentially funded through carbon offsetting, that would sustain and enhance peatland's long-term sequestered carbon store.

2.6 Marches Mosses BogLIFE Project – An example of lowland peat restoration in progress

Robert Duff and Sophie Laing Natural England, Marches Mosses BogLIFE project.

Fenn's, Whixall, Bettisfield, Wem & Cadney Mosses Special Area of Conservation (the Marches Mosses) straddle the English/Welsh border near Whitchurch in Shropshire, and Wrexham. Together, the Mosses form a 1,000 hectare rainwater-fed lowland raised bog - a climax community. They developed here because of the amazing powers of *Sphagnum* bogmoss, creating cold, water-logged, nutrient-poor acidic conditions. Over 10,000 years, this resulted in the accumulation of a saturated peat dome 10m higher than the current flat, drained landscape. The bog swallowed up the wildwood and spread over the plain of glacial out-wash sand, to the limits of its enclosing moraines.

However, for the last 700 years, this huge wilderness has been drained for agriculture, peat cutting, transport systems and more recently forestry and even a scrapyard. The centre of the Moss had a peat cutting drain every 10 m; peat was stacked as far as the eye could see and mire plants and animals had been eradicated from most of the site. A large increase in the rate of commercial peat cutting in the late 1980's led NGOs to form the Peatlands Campaign Consortium to save the Mosses and others like it. The Nature Conservancy acquired the centre of the Moss in 1990 as a nature reserve and ever since then work has been underway to restore this precious peatland habitat, which is also incredibly important for its enormous store of carbon - 1.1 million tonnes according to a recent estimate.

In 2016, an opportunity to purchase more peatland on the edge of the Mosses led to a successful funding bid for the six-year, £6 million pounds Marches Mosses BogLIFE Project, funded by European LIFE and the National Lottery Heritage Fund. Its goal is to make a step-change in the hydrological restoration of 660ha of the Mosses through a partnership of Natural England, Natural Resources Wales and Shropshire Wildlife Trust. Importantly, the BogLIFE Project addresses a problem affecting all British raised mires – the loss of our mire edge "lagg" communities (fen, carr and swamp). The high water table of the "lagg" is important as it sustains that of the mire's central expanse. The Project team went about buying another 100ha of marginal forests, woodland and fields, clearing trees, disconnecting under-drainage, stripping turf, re-seeding 3 ha of cleared peat with Sphagnum and using a new technique of linear cell damming or "bunding" (270 km completed) to restore water levels across 660 ha. "Lagg" streams such as the Bronington Manor Drain which were canalised within the peat to lower the marginal water tables during the Enclosure Awards 200 years ago, have been re-routed back to the bog's margin, to enable disconnected areas of peat to be hydrologically reunited.

The BogLIFE Project also involves adjusting dams on the central mire areas and bunding peat areas that haven't got a cutting pattern to dam. A scrapyard has also been cleared up and the project has started to tackle a problem that affects most nature conservation sites nationally – high levels of aerial nitrogen pollution and, at the Moss, its consequent high coverage of purple moor-grass at the expense of desirable sphagnum moss species.

Analysis of monitoring results indicate that recent rewetting works are effective at raising water levels. A case study considered Bettisfield Moss which was bunded in 2017/18 and 2018/19.

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• Water levels recorded in 2019 are significantly higher than previous years across Bettisfield (9.7 cm – 18.1 cm mean increase per management group relative to 2018).

• Based upon the linear relationship between annual precipitation and mean annual water level, Bettisfield dipwells located near bunding in 2017/18 are up to 35 cm wetter than expected for precipitation received within 2019.

In terms of habitat change, a habitat map was produced for an area of 794 ha using multispectral and Lidar imagery captured in July 2021. It was created using an object-based image analysis process. From analysis it is estimated 46% of the area held 'wet' bog habitats (cotton grass, heath, mixed water and vegetation). 22% was classed as purple moor grass, 13% as bracken and 9% as trees and scrub.

Recovery and rehabilitation of large severely degraded lowland peatlands such as this require considerable resources and take many decades, but substantial improvement in condition is achievable.

More information available at: https://themeresandmosses.co.uk/marches-mosses-boglife/

Conference speakers and organisers (left to right: Richard Grindle, Sophie Laing, Neil Brown, Dr Julia Casperd, Scott Kirby, Kate Mayne, Robert Duff, Renee Kerkvliet-Hermans, Professor Fred Worrall and Dr Chris Field)

3.0 Summary of feedback from workshops

The following section details feedback from the face to face and online discussions as part of the workshops.

3.1 Workshop A: Best Practice for Carbon Storage and Sequestration

Dr Simon Jeffery

3.1.1 Social barriers to the restoration of lowland peatland for carbon

Communication is key when restoring of peatland. Lack of communication regarding and understanding of these valuable ecosystems can lead to the public causing further damage. A point in case is the passionate drive by the public to plant trees. Campaigns for tree planting should be well informed and advocate the right tree in the right place and the right habitat restoration in the right place. They also place more value on sinks, such as trees, rather than stores such as peat soils. The public also need to be educated about the need for tree removal on areas of lowland peatland to maximise peatland restoration. The public seem to be unaware of the change of priorities and that restoring peat to fight climate change is of more importance for carbon than planting trees. The message regarding climate change to the public needs to be simple to create impact but it also needs to make them aware of the need for productive restoration and the importance of food security. In addition, the public need to become more familiar with wetland habitats and engage with their story by dispelling mistruths, e.g. about wetlands encouraging mosquitoes and midges, by providing better access to experience peatlands. A common language needs to be created to underpin this process.

Farmer engagement is seen as a significant barrier and the issue of degraded and degrading lowland peatlands needs to be addressed with unilateral government policy which raises awareness and provides long term support to sustain the livelihoods of farmers and landowners who have peaty soils. Facilitation groups using demonstration sites and providing peer to peer support and industry expertise will prove important going forward.

There also needs to be fairness and equality in terms of the distribution of the grants. When restoring at scale, land ownership will prove a significant barrier and needs to incentivised. Flooding is not an issue for most people, so there is not the appreciation of need for natural flood management. Complacency is prevalent and landowners sometimes aim to maintain the status quo and do nothing rather than improving the habitat. Confidence needs to be built among farmers and landowners that alternative use of lowland peatland is viable.

3.1.2 Social drivers for lowland peatland restoration for carbon

Placing value on a species associated with peatland may be used as a tool to promote the importance of the peatland ecosystem. However, there are not charismatic, species that come to mind in the same way that elephants and lions are associated with African savannahs for example. Creative story telling around wetland birds could go some way to addressing this.

3.1.3 Economic barriers for lowland peatland restoration for carbon

Financing the support and expertise required to restore lowland peatland needs an integrated and long-term programme of funding due to the fact that it is information intensive. This needs to include 'buffering' to establish farming systems, such as paludiculture, which may not be immediately successful due to lack of knowledge or resources.

Carbon credits

It is essential that the infrastructure surrounding the buying and selling of carbon credits is trusted. Key issues with a trusted carbon market include: regulation, land tenure, maintaining profitability and a lack of baseline data regarding costs and validation. Blended finance options are perceived as too risky. Even though The Peatland Code provides insurance against this risk, it is thought the government should consider incentivising landowners and farmers to enter into the process of restoration to create carbon credits.

Paludiculture crops

It is likely that crops grown on lowland peatland as part of a paludiculture system will need to be high value, replacing like for like since crops currently grown on such productive soils are currently high value. Developing a system of paludiculture will need industry partners with relevant knowledge. The question is: are there industry partners which have this expertise in irrigation and harvesting on wetted peat in a manner that also minimises emissions? Research is required and finance of that research is also a pre-requisite to create knowledge that can then be transferred to farmers and landowners.

Legislation

The lack of legislation regarding the protection of lowland peatland carbon stores is a barrier to engagement which is further complicated by the variable and lengthy timelines which are discussed: 2030/2040/2050.

Depth of peat

How is this market scaled up? Some pockets of lowland peatland are too shallow so in themselves are not a valuable carbon store and the time it would require to sequester enough carbon to create additional carbon credits would likely take too long. Financial support would be required to make this an economically viable option.

3.1.4 Economic drivers for lowland peatland restoration for carbon

The drivers for restoring lowland peatland are as follows: if it is as part of local nature recovery it could be sold as carbon credits. This would need to be measured and monitored and potentially revalued over time. If the peatland is being restored whilst also being farmed (paludiculture) then the drivers are twofold. First, the carbon store and rate of sequestration of carbon could be sold as carbon credits and thus help to offset a farmer's carbon emissions. Second, financial gain from the sale of a paludiculture crop may further encourage restoration.

3.1.5 Environmental barriers for lowland peatland restoration for carbon

Woodland planted on lowland peatland dries it out which will cause degradation and carbon emissions but these woodlands maybe more biodiverse than wetlands. It is clear that education is required regarding the concept of biodiversity. Is it important to just have lots of species? How many of each is required (abundance)? And should there be consideration of appropriate species assemblages? Removal of a plantation on peatland will result in biodiversity loss but it is an appropriate management technique to restore a priority habitat and protect an important carbon store and will potentially result in overall Biodiversity Net Gain (if there are other woodlands) across a landscape/farm of a different assemblage.

Peat based composts

Government policy should ban the cutting or removal of peat for any product. These should be banned immediately thus eliminating use of for peat as a product.

Tillage and traffic

Carbon emissions from lowland peatlands which are farmed using conventional practices may be reduced by using specific tillage and traffic systems (e.g. no till). However, tilling is still required for certain crops, e.g. potatoes. If this is to be a sustainable farming practice on lowland peatland more research is needed to provide alternative ways of producing these crops to reduce emissions and sequester carbon.

3.1.6 Environmental drivers for lowland peatland restoration for carbon

The protection of carbon stores through habitat restoration and wet farming will prevent further emissions as a result of peat degradation. This, in conjunction with carbon sequestration via appropriate cropping and re-vegetating (sphagnum plug planting etc.) will help to mitigate climate change and other negative environmental effects, e.g. acidification of the sea which occurs as a result of elevated levels of atmospheric CO2. Local adaptation and local provision in terms of blended finance will prove more trustworthy.

3.2 Workshop B: Best practice for Nature and Ecosystem Services

Dr Julia Casperd

3.2.1 Social barriers for lowland peatland restoration for Nature and Ecosystem Services

The election cycle and the lack of scientists within government was seen as a major barrier to the restoration of lowland peatland for biodiversity. Despite scientific advisors, valuable information gets lost in translation. How does one optimise land use? One solution would be to increase the intensity of farming in some areas to free up land for local nature recovery elsewhere. There are important health and wellbeing benefits associated with wetland areas in terms of outdoor space, bird life etc. but recreational and cultural value is harder to cost and will vary according to the location.

3.2.2 Social drivers for lowland peatland restoration for Nature and Ecosystem Services

Social drivers of lowland peatland restoration include: Net Zero ambition views; collaboration; green credentials; climate change; pioneers and an increased awareness/education. An appreciation of the importance and uniqueness of peatlands and wetlands should be promoted through TV programs such as Countryfile, with celebrity endorsement and peer to peer story telling which would in turn drive biodiversity tourism. History and cultural links with peatlands can engage and create interest and appreciation of these habitats. Historically, wetlands were part of rural populations' everyday life, providing jobs, income, social life and a sense of community. Reconnecting with this history would support local perception of peatlands.

3.2.3 Economic barriers for lowland peatland restoration for Nature and Ecosystem Services

The loss of productive land is a significant barrier to farmers when considering the restoration of lowland peatland. This is especially so if they were to restore for biodiversity and carbon though habitat creation rather than for just carbon by undertaking paludiculture. Evidence and policy barriers include the ease/cost of measuring and policing; DEFRA turnover; lack of policy maker understanding; voluntary codes; minimal research/data; large variances within modelling tools leading to differing results and data. The power of supermarkets to drive demand needs to be addressed especially in relation to new crops produced within paludicultural systems such as cranberries. There are no clear established markets

3.2.4 Economic drivers for lowland peatland restoration for Nature and Ecosystem Services

The sale of carbon credits and the establishment of trusted markets e.g. farmers within a county providing carbon credits/biodiversity credits for each other are key drivers of the restoration of lowland peatland. It may be possible to use the process of habitat restoration for the purposes of diversification and tourism, which would also provide an income by using marginal and otherwise unproductive land for biodiversity credits which also act to protect carbon stores would be doubly beneficial. It is predicted that the Environmental Land Management Scheme will reward the protection of ecosystem services relating to pollution, water quality etc.

Optimising ecosystem services is a key driver of peatland restoration. Since the funding of clean water and natural flood management, i.e. flooding economics (cost/benefit analysis) are clearer it would possibly be easier to measure and monitor these rather than CO2 emissions and Biodiversity Net Gain which are both difficult to quantify.

3.2.5 Environmental barriers for lowland peatland restoration for Nature and Ecosystem Services

Planning and zoning to protect peatlands should be an integral part of planning policy. Biodiversity Net Gain targets should also be set and monitored. Where is the best land for local nature recovery? Ground-truthed geospatial assessment and measurement could be used to map suitable areas for restoration with paludiculture and restoration via habitat restoration. There is a lack of funding in the environmental sector. Optimising biodiversity should be embedded in policy as part of, e.g. protected species legislation, land designations etc. Funding should be underpinned by the UN Sustainable Development Goals.

There is a high level of upfront costs. Is restoration forever? Identification of sites to attract corporates was thought to be important going forward. Protected species (e.g. badgers) may be an issue when trying to restore lowland peatland. In addition, a lack of ecological expertise will be significant when trying to assess and monitor biodiversity; and techniques to simplify this process such as eDNA analysis are expensive. Recently there has been a decline in such skills and the government needs to promote education in Ecology/Natural History whilst supporting accreditation and upskilling.

Stewardship grants are insufficient in competition with grants from companies like solar panels to encourage farmers to restore lowland peatland for nature. Neighbouring farmers can also hinder re-wetting, as can drainage boards, if they think it will affect their land adversely. A more co-ordinated approach among organisations on a landscape scale is required since they are trying to achieve the same end goal but lines of communication are not open and people/organisations are operating in silos.

There needs to be a better understanding of using different sources of funding and the implications of this for personal and business taxation. Other barriers to restoration include the fact that there are no payment codes for lowland restoration; the Peatland Code currently excludes lowland peatland; and there are no condition codes for lowland peatland. Furthermore, there are no clear time lines for achieving biodiversity net gains (BNG) and there are insufficient means for measuring them accurately and easily. High tech collaboration with engineers to create intelligent solutions is required.

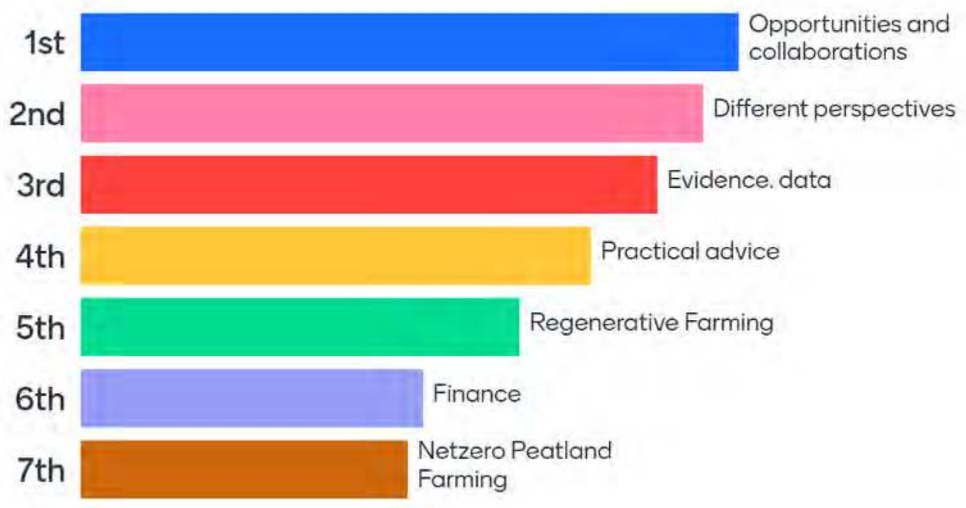
3.2.6 Environmental drivers for lowland peatland restoration for Nature and Ecosystem Services

Better evidence, less risk, more certainty, and bigger more robust markets will drive public sector investment and planning zoning to protect peatlands i.e. built into planning policy. Assessing land use in terms of carbon will be a key environmental driver for lowland peatland restoration. Practical advice and support for farmers is crucial regarding Corporate Social Responsibility reporting; market for carbon credits and ecosystem services with appropriate regulation. There needs to be more transparency in carbon accounting and trading opportunities. Opportunities for water retention in lowland peatland have the potential to be huge drivers of change of perception due to reduced flooding in urban areas; especially when it comes to the farming of lowland peatland. Paludiculture, and as a productive form of lowland peatland restoration, if done so as a mosaic/strips of different crops and wetland vegetation has the potential to facilitate Natural Flood Management, benefitting the landowner and the surrounding area and catchment and also local nature recovery.

4.0 Conclusion

It was clear from the conference feedback (see Figure 3) that there is plenty of scope for further workshops and conferences to facilitate knowledge transfer in this area of regenerative agriculture and peatland restoration. The key areas to focus on include blended finance, paludiculture practices and regenerative farming. The talks were successful in providing preliminary practical advice and data/evidence in support of the restoration of lowland peatland for carbon and local nature recovery. The main successes of the conference appeared to be in providing networking opportunities and collaborations; and the chance to look at lowland peatland restoration in a different way ('Different perspectives').

Figure 3 Infographic showing how online and face to face delegates ranked the contributions of the conference to different criteria.



4.1 Summary by Richard Grindle (CEO Shropshire Wildlife Trust)

Richard Grindle provided an eloquent summary of the conference.

"We have had fascinating presentations on lowland peatland, the challenges we face but also what can be done to address them if we have the right systems and incentives – by scientists, by farmers and land managers, and by NGOs.

Peat matters: for biodiversity; for health and wellbeing; and above all for carbon. UK peatland stores 5.5 billion tonnes of carbon, but is currently a currently net emitter; globally, loss or damage to peatlands causes around 10% of all global emissions. And lowland peatland matters: one sixth of all UK peat is lowland; and we have 8,000 hectares of it in North Shropshire. Over 90% of lowland peat has been drained for agriculture. And a third of the UK's emissions from peatland – and 3% of all UK emissions - are from drained lowland peat.

This is absolutely not to point the finger at farmers. Peatland was brought into cultivation because we needed to feed a growing population, and it was done with government encouragement and support. But we now need to change the direction of travel. In crisis there may be opportunity: there are huge economic and environmental benefits from protecting and restoring lowland peatland. We do not yet know how green financing will work, but today's sessions have given us some useful pointers.

What is certain is that we need to combine the three pillars of sustainability: Social, Economic and Environmental. Farmers have to find ways of producing food at a profit whilst protecting and restoring nature. Conservation can only work in the context of a farmed landscape, and in partnership with land managers. And both can only succeed with the support of the wider population."

5.0 Appendices

Appendix 5.1

Conference Programme

Restoring Lowland Peatland for Biodiversity & Carbon:

Lessons from the Meres and Mosses

Harper Adams University

Wednesday 20th July 2022

This conference has been supported by LIFE Programme of the European Union and The National Lottery Heritage Fund.

8.30 - 9.00 am Tea & Coffee with networking/posters

9.00 am Welcome & Introduction (Julia Casperd) & Introduction to the Restoring the Marches Mosses BogLIFE Project (Robert Duff)

9.30 am Dr Renee Kerkvliet-Hermans, IUCN

'The Peatland Code'

10.00 am Scott Kirby, Harper Adams University

'Barriers to Regenerative Agriculture'

10.30 am Dr Neil Brown and Kate Mayne, North Shropshire Farmers Group

'Peatland restoration opportunities and challenges – the landowners' perspective'

11.00 -11.30 am Tea & coffee with networking/posters

11.30 am Professor Fred Worrall, University of Durham

'Carbon modelling at Whixall Moss'

12.00 pm Dr Chris Field, Manchester Metropolitan University

'The Carbon Farm'

12.30 pm Robert Duff (Project Manager) and Sophie Laing (Project Monitoring Officer) Marches Mosses BogLIFE Project.

'Peatland restoration for nature and ecosystem services'

1.00 - 1.45 pm Lunch – a buffet lunch will be provided

Workshops (1.45 – 3.00pm)

Workshop A: Best Practice for Carbon Storage and Sequestration (Simon Jeffery). 35 minutes

Workshop B: Best practice for Nature and Ecosystem Services (Julia Casperd).

3.00 - 3.15 pm Workshop A Feedback & Q&A

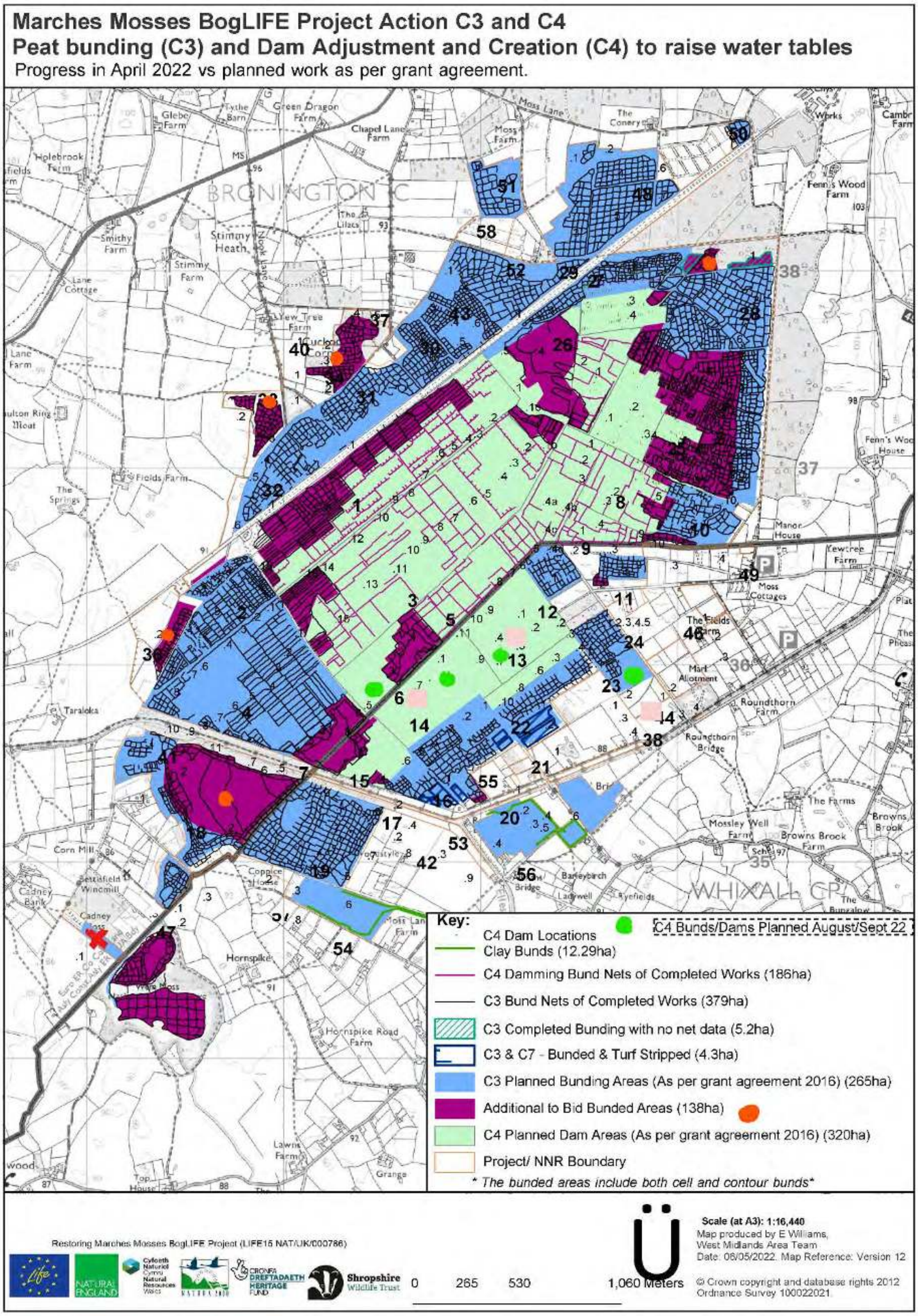
3.15 - 3.30 pm Workshop B Feedback & Q&A

3.30 pm Tea & coffee with networking/posters

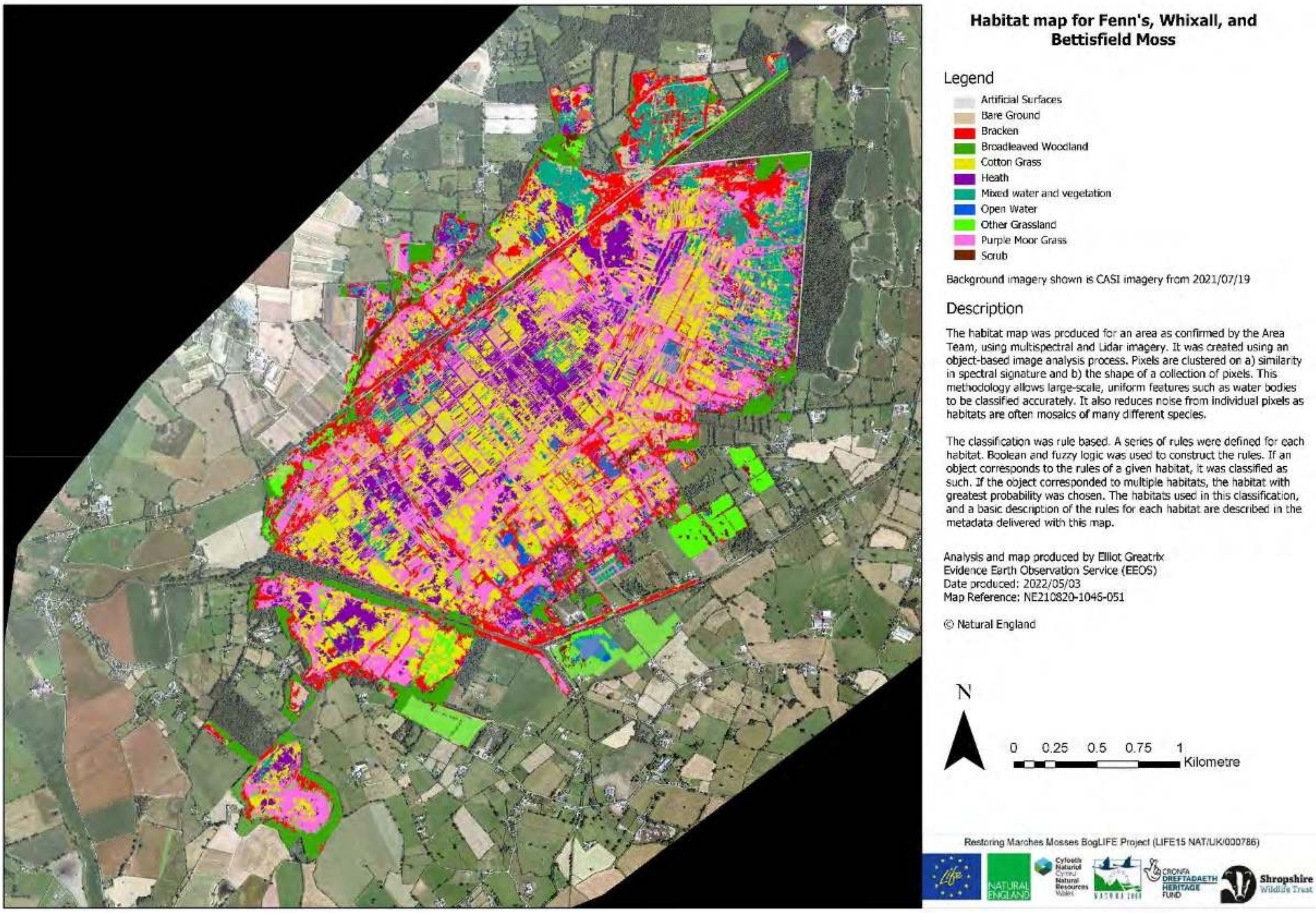
4.00 pm Summary and conclusions (Richard Grindle CEO Shropshire Wildlife Trust)

4.30 pm Optional tour of Harper Adams University Farm led by Julia Casperd to demonstrate the different options (re-wetting & diversification) available to farmers in lowland peatland management.

5.2 Appendix 2 Map of Bunding Bid vs Actual Works 2021



5.3 Appendix 3 Map of Habitat



5.4 Appendix 4. Table of face-to-face delegates (N=38), occupation and reasons for attending the conference.

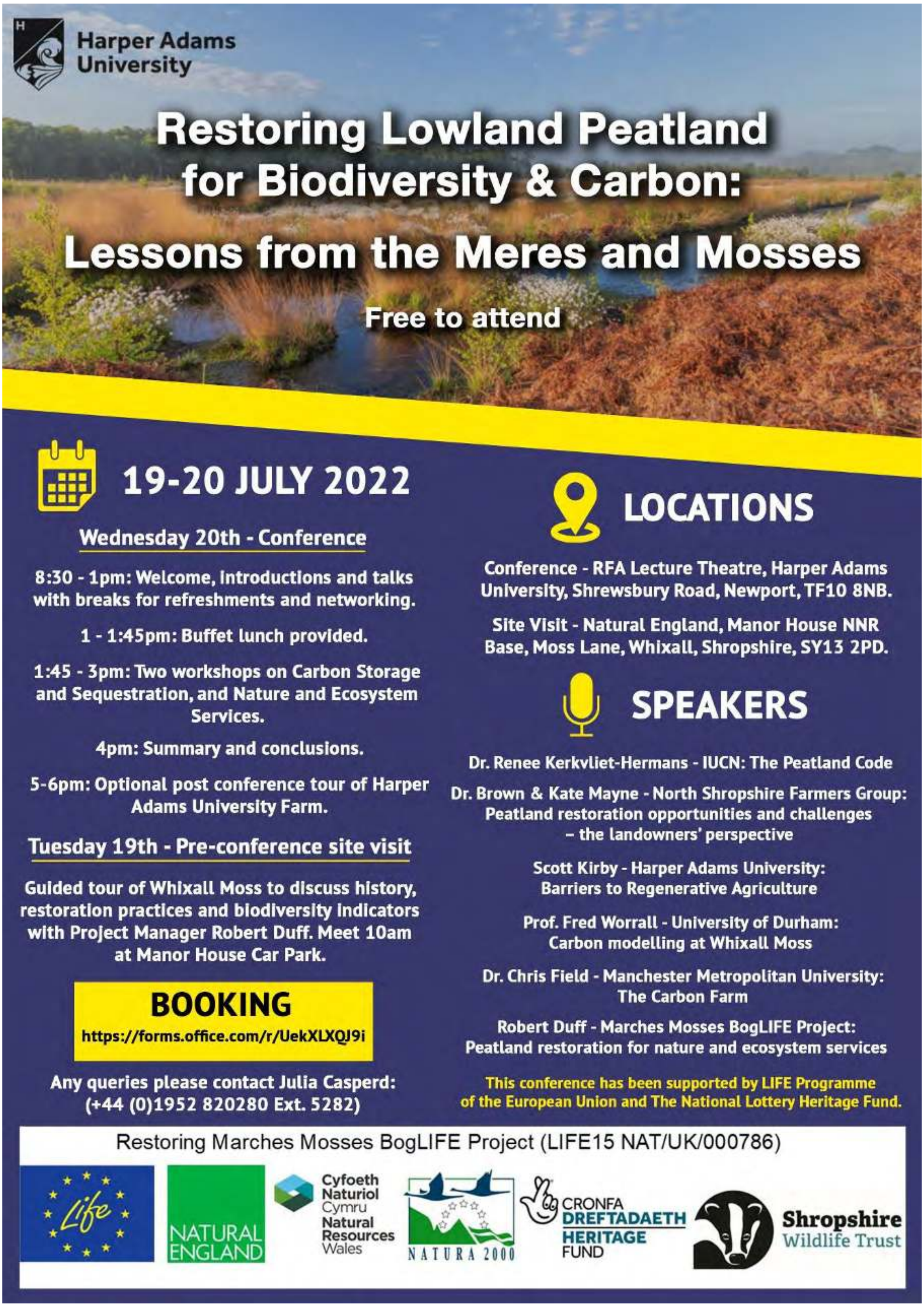
Name	occupation	What do you hope to get out of this conference?
Sanne van der Meer	Financial advisor at Finance Earth	To understand the key considerations from an agricultural perspective.
Terry Pickthall	Senior Lecturer & Placement Manager, Agriculture	An insight into regenerative practice at Whixall.
Mrs Sarah Pickthall	Senior Lecturer (Engineering)	Interested in restoration of local raised lowland peat bogs (Hatfield).
Miss Harriet Santon	Project Officer (HHL), Lincolnshire Wildlife Trust	Understanding of The Peatland code/benefits/barriers to restoration.
Lewys Wheeler	Project Officer	Application of techniques to peat restoration in Norfolk.
Miss Clorinda Graham	Lecturer	CPD
Mr. Vincent Smith	VP Staffs WT; Non-Executive Dir. Ecology Building Society	Understanding techniques to restore peatlands for C capture/biodiversity.
Mr Tom Furness	Programme Leader	CPD
Cath Edwards	Agri Advisor	Peat restoration knowledge
Johnny Campbell	Natural Capital Broker	Understanding of Lowland Peatland C & establish industry connections
Emma Abbott	Senior Environmental Scientist, Severn Trent	Challenges around regenerative agri/C sequestration opportunities.
Allan Wilson	Chair of Save our Shropshire	Understanding of this important natural based sequestration process
Sarah Johnson	Peatland Project Manager, LWT	Share learning on restoration/sustainable management/funding of LP.
Caroline Savage	Regional Manager Midlands EA	Environmental Project Manager
Gigi Hennessy	Carbon Officer	Learn about peatland restoration/impacts on C storage and sequestration
Mr Mike Longden	PhD researcher & peatland restoration officer	Best practice and make new contacts.
Miss Lucinda Lycett	Flood risk manager	Better understanding of how peat stores carbon and interacts with water
Jasjit Cheema	Civil Engineering Apprentice	Insight into lowland peat and how it can affect biodiversity/carbon.
Dr Stephanie Evers	Reader in Wetlands Ecology and Biogeochemistry	Successes and challenges of LP & accumulation in peat landscapes
Dr Lucy Witter	Nature-based farm advisor	Greater insight
Gareth Brookfield	Nature Recovery Programme Manager - Cheshire Wildlife Trust	Networking, lessons learned and future opportunities
Helen Dale	Rural Adviser	Knowledge transfer with members of the CLA.
Miss Kate Goodman	Student	I love peatlands and I'd like to hear professionals speaking about the topic.
Guy Pluckwell	Catchment Co-ordinator (EA)	Greater understanding of the opportunities
Ceri Meehan	Catchment Sensitive Farming Adviser	More info on peatland restoration and networking
Sophie Park	HE Lecturer	A greater understanding of our management for biodiversity/sustainability
Ms Hannah Curtis	Project Assistant	Information re the practicalities & alternative incomes on Agri land.
Mr Ralph Connolly	Senior Living Landscapes Officer for Cheshire Wildlife Trust	information gathering/ best practise to inform work in the Cheshire Peaks
Lucy Ledlie	Catchment Sensitive Farming Advisor	Improved knowledge on carbon & to learn about projects in the area.
Howard Smith	Farm Manager	Information on restoration
Sarah smith	Farmer	Understanding restoration and farming
Jarod Crossland	Engineer	Understanding of peat restoration

Name	occupation	What do you hope to get out of this conference?
Dr Sandra Pattinson	Knowledge Exchange Coordinator	Information re the practicalities & alternative incomes on Agri land.
Ms Sadie Manning	Partnerships Coordinator - Beadamoss	Knowledge/latest evidence of C sequestration potential on restored LP
Ms Jacqueline Wright	Communications	Networking with other peatland organisations and researchers
Miss Milly Robinson	Ecologist at Forestry England	Learn more about peatland restoration/application
Chris Eckton	From Forestry England	Learn more about peatland restoration/application
Graham Borden	Living landscape officer	Knowledge of best ways to restore peat bodies

5.5 Appendix 5

Table of online delegates (N=21), occupation and reasons for attending the conference

Name	What is your occupation?	What do you hope to get out of this conference?
Andrew Howe	Artist/Environmental Consultant	Understanding of how to support farming lowland peatland.
Beth Pudifoot	Somerset Peatland Partnership GHG Officer	Learn more about peat restoration from the carbon perspective
Bethan Stallwood	Senior Lecturer	Research ideas and collaboration
Caitlin McQueen	Lecturer	focus on assessment in labs & networking.
Deniz Ateş PhD student	PhD student	
Denny Carriel		
Emma Abbot	Senior Environmental Scientist, Severn Trent	Challenges around regen agri.
Eric Siqueiros	Innovation Manager/Lecturer at Harper Adams	Regenerative agriculture practices, opportunities for C storage
George Jones	Land drainage/management installation/design	To gain further knowledge
Jack medlock	Ecology, Heritage and Planning Central England	
Jemima Western	Somerset Peatland Partnership Farm Liaison Officer	learn about peat restoration/ELM application to Somerset Levels
Jo Finlow	Project manager peat restoration project	information on lowland peat restoration
Joey Dunn	Rural Surveyor	A greater understanding
Matthew Quinn	Project Assistant with Lincolnshire Wildlife Trust	As much knowledge as possible
Megan Hudson	Leader Fenland Soil	Networking and information gathering.
Pascale Bodevin (Mrs)	Business development officer	Understand the Peatland Code to explain to farmers.
Paul Lindop	Agri Solutions Architect	Case studies and new ideas
Paul Schofield	LIFE Moor Space Project Manager	Understanding of peatland restoration
Sarah Darrah	Investment consultant	Better understanding of lowland peatland restoration
Siobhan Smyth	Programme Leader	CPD
Sophie Bowers	Placement student	The current and future solutions for lowland peat



Restoring Marches Mosses BogLIFE Project (LIFE15 NAT/UK/000786)