Peatland carbon finance scoping study

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Further information

This report can be downloaded from the Natural England Access to Evidence Catalogue: http://publications.naturalengland.org.uk/. For information on Natural England publications contact the Natural England Enquiry Service on 0300 060 3900 or e-mail enquiries@naturalengland.org.uk.

Key Messages

The purpose of this study is to understand the emerging market for peatland carbon finance, consider the opportunities and risks and identify the issues that need to be addressed if the peatland carbon finance market in England is to reach its full potential.

1. Degraded peat is a significant greenhouse gas (GHG) source. Restoring peat to a good condition has the potential to significantly reduce GHG emissions as part of a net zero target (HMG. 2021b). This is recognised in the government's Net Zero Strategy which proposes ambitious targets for 280,000 hectares (ha) of peatland restoration (HMG. 2021c) and sets the context for this report.
2. This report shows that private carbon finance can make a significant contribution to the costs of restoring and managing peat, with a particularly high contribution for lowland peatland restoration.
3. Public funding will continue to be needed. There is an opportunity for the new Environmental Land Management Scheme (ELMS) funding to be designed so that it encourages and complements private carbon finance.
4. Restoring peatlands is expensive and landowners face a significant cashflow challenge. Price guarantees or loans may address this. The need for price guarantees is recognised in the England Peat Action Plan (EPAP) (HMG. 2021d).
5. The peatland carbon market is at an earlier stage of development than the woodland carbon market (Confederation of Forest Industries. 2021). If the market is to grow at the pace needed, the following issues need to be addressed:
    a. Landowners need to support peatland restoration and need to recognise the market value of the resultant carbon units.
    b. The benefits of peatland restoration need to be widely promoted. This is recognised in the EPAP.
    c. Carbon buyers need clarity about how UK peatlands GHG abatement units can be used for net zero reporting. In this report, abatement is the term used to mean emission reduction achieved by peatland restoration rather than sequestration, which is the removal of GHG from the atmosphere.
    d. More work is needed to understand investor and buyer attitudes to natural capital projects including peatland carbon finance.
    e. Carbon finance needs to be compatible with other private finance such as that from Flood Risk Management (FRM) and water quality improvements (HMG. 2021d).
6. Markets require good governance and transparency, based on good data, standards, and accreditation. The Peatland Code (IUCN. 2017) meets all these criteria and is being expanded to include lowland fen peat.
7. Realising the potential of peatland carbon finance will require a commitment of resources to monitor progress and address challenges.

Executive summary

Peat soils in England store a vast quantity of organic material that has the potential to emit greenhouse gases (GHG) (HMG. 2021c). Emissions from degraded areas of peatlands are estimated at 24.5 Mt CO_2 equivalent (CO_2-eq) per year, representing 4.5% of total UK GHG emissions (CCC 2020a & b). Urgent action is therefore needed to abate or reduce emissions source.

The government's Net Zero Strategy (HMG. 2021b) contains an ambitious target of 280,000 ha of peatland restoration by 2050, which if realised, would have the potential to make an estimated 1.58 million to 3.51 million GHG/carbon units available[1]. This restoration could also make a significant contribution to the 25 Year Environment Plan which commits the UK government to restore or create 500,000 ha of wildlife-rich habitat including peatland habitats (Defra. 2018).

Assuming conservative market prices, income from the sale of these GHG/carbon units could, in principle, make a significant overall contribution in the region of £1bn[2] to the total cost of this restoration (estimated to be up to £1.1 bn) and ongoing management, if a fully functioning market could be established. The extent of this financial contribution does, however, vary considerably across different peatland types, with a relatively low potential contribution (circa 25%) for landowners undertaking upland peatland restoration and a much higher contribution (typically >50%) for those delivering lowland restoration.

Significant progress has been made over the last two decades in our understanding of effective techniques for peatland restoration, associated costs and projected impacts on GHG emission abatement (reduction in GHG emissions rather than sequestration that is the removal/absorption of GHG from the atmosphere). This, combined with a robust methodology for the validation and verification of carbon units provided by the Peatland Code (IUCN. 2017), creates a strong foundation to secure private investment in peatland restoration through carbon finance.

The carbon market generally considers both sequestration and abatement but the Peatland Code currently only covers abatement and its associated trading. The potential to generate carbon revenue from GHG sequestration from a peat bog in favourable condition is limited at the moment by a lack of scientific evidence, so the primary focus of this report is on financing restoration through emissions abatement (IUCN. 2021).

Peatland carbon finance is a new funding source for the land management sector and has the potential to significantly contribute to environmental goals alongside public funding if a functioning market can be established. In comparison to the market for woodland carbon

[1] Net figures based on Peatland Code-level reductions for scientific uncertainty and a risk buffer.

[2] Discounted figure (see Appendix 3. Table 8 Present value of income).

units, which is now well established and rapidly growing, the peatland carbon market is at an earlier stage of development (Confederation of Forest Industries. 2021).

This report brings together information and sets out what is currently known about the developing peatland carbon market and its viability, set against the wider context of private sector investment in GHG reduction. It also identifies the issues which will need to be addressed if this opportunity is to be realised. The key issues can be summarised as follows:

a) Financial viability and risk

Based on current market structure and trends in carbon market prices, public funding is likely to continue to need to make a significant contribution towards costs of initial restoration (particularly for upland peat), ongoing maintenance and opportunity costs (particularly for lowland peat, where restoration may lead to reduced agricultural productivity). The Environmental Land Management Scheme (ELMS) will need to be designed to encourage and integrate with other sources of funding for peatland restoration and management.

Even when carbon units are sold at the “pending issuance” stage (i.e. after restoration and before the year 5 verification), there is a significant short-term cashflow challenge for landowners in the initial phase of restoration and an associated risk that carbon unit sales may not achieve a projected return. The option of a publicly funded loan or price guarantee scheme might be used to address this, particularly for lowland peat, for which carbon revenue has the potential to fund most of the restoration costs.

An alternative option may be to raise private capital funding from institutional investors, although this would be dependent on a functioning market (to generate investment return) and may require significant project aggregation (to achieve scale), which may be counter to buyers’ expectations to associate with specific projects. This warrants further investigation, but it is unlikely to provide an immediate short-term solution to the cash-flow challenge.

Sections 4.5 (particularly Landowner cashflow modelling) and 5.5 provide further information.

b) Landowner interest and willingness

The government’s Net Zero Strategy (HMG. 2021c) does not state where the 280,000 ha of peatland restoration is to be delivered, but some proportion of this will need to come from lowland peat. However, the Climate Change Committee (CCC) Balanced Net Zero Pathway (CCC. 2020a) target assumed 75% of lowland peat soil to be taken out of intensive production. Landowners, particularly of lowland peat, may be reluctant or unconfident to offer resultant carbon units to market, based on concerns over:

- The impact on the future economic activity and productivity of the land and associated risks (financial/tax implications and long-term commitments), or

- Uncertainty about how to make the most of the market income and public funding options that may be available to them.

Sections 4.2 and 5.2 provide further detail.

c) Building awareness

Alongside the more tangible issues listed, awareness and understanding of the opportunity for peatland carbon finance is limited. Awareness of the Woodland Carbon Code has increased greatly in the last two years, leading to a rapid increase in interest and investment in woodland carbon units (Confederation of Forest Industries. 2021). An awareness building campaign for peatland carbon would be helpful, targeting both landowners and potential buyers.

Sections 4.2, 4.4, 5.2 and 5.4 provide more information.

d) Scope of the Peatland Code

The Peatland Code (IUCN. 2017) (see Section 3.3 and Appendix 1) currently provides a mechanism for the validation and verification of carbon units generated from restoration of upland and lowland peat. Whilst other standards may be developed for use, the Peatland Code provides a robust basis for market development. Its scope does, however, need to be extended to cover restoration of lowland fen peatlands as well different restoration types e.g. trees to peat. Further consideration should then be given to whether its scope should be further extended to carbon sequestration from peatlands under restoration.

e) Buyer benefits relative to other investment options

The policy and regulatory context which determines how potential buyers of carbon units can account for and report such units is complex and evolving. There are three areas of limitation or uncertainty which may affect the likelihood of investment in peatland carbon units relative to other investment options:

- The contribution of offsetting as part of a corporate net zero target, for which the focus should be on driving down emissions within an organisation's value chain. SBTi guidance, recently revised, now recognises the potential need for 5-10% of residual GHG emission to be achieved through offsetting (Science Based Targets. 2021).
- The potential for domestic land-based projects to be recognised and reported as offsets. This is currently prevented under the UK government's Environmental Reporting Guidelines (HMG. 2019a), whereas SBTi guidance on offsetting includes reference to woodland carbon (but not peatland restoration).
- The recognition of the contribution that GHG emissions reduction (abatement) can make compared with GHG emissions removal (sequestration) in achieving a net zero position, given that an abatement unit does not negate the impact of GHG emissions elsewhere, whereas a sequestration unit does.

There is a significant risk that these factors limit the demand for peatland carbon units to being purely Corporate Social Responsibility (CSR) driven, at a time when investment is shifting rapidly towards achievement of formal net zero targets. Whilst an element of CSR motive will be helpful in driving a demand for premium-priced carbon units bundled with other environmental benefits, carbon unit purchases driven purely by a CSR motive would need to sit alongside a robust net zero strategy to avoid the risk of accusations of greenwash (SBTi. 2021).

Conversely, net zero targets (which include supply chains) are likely to drive an increase in investment in peatland restoration which will affect some landowners directly (where they have net zero targets in their own right) or indirectly (as suppliers to large corporates). Offsetting is also likely to remain an important investment option for those needing to mitigate some residual emissions in their net zero strategy. It is important therefore that reduction of land-based GHG emissions and the protection of the peatlands that can become GHG stores are recognised and encouraged as a valid net zero investment option or priority. The Voluntary Carbon Market Integrity Initiative has recognised the issue and is seeking to address it (VCMI. 2021).

There is anecdotal evidence that there is considerable interest and demand from potential buyers of peatland carbon units (Confederation of Forest Industries. 2021). More work is needed to understand carbon unit buyers' attitudes, aims and understanding of this wider policy context.

Sections 4.6 and 5.6 provide additional detail.

f) Maximising private investment from other sources of green finance

The concept of stacking income from peatland carbon with other sources of green finance is very new. There is more to understand about how peatland carbon could be combined with ecosystem services or Biodiversity Net Gain (Defra. 2018). The Natural Environment Investment Readiness Fund (NEIRF) will increase our understanding of the potential market for peatland carbon (Environment Agency. 2021) and the possibilities to create income from the carbon units alongside income from other ecosystem services e.g. particularly flood risk management and water quality improvement.

Section 4.5 provides additional information.

The peatland carbon market is less well developed than the woodland carbon market in England (Confederation of Forest Industries. 2021). Better understanding of the motivations of buyers and sellers is needed, along with improved awareness of the Peatland Code and the opportunities it presents. Extending the scope of the Peatland Code to cover lowland fen peat, and potentially sequestration, could increase its use substantially. Natural England recognises the important role that carbon finance can play in restoring peatlands for the climate and for biodiversity and will work with others to address the barriers and opportunities outlined in this report.

Contents

1 Project aims

Peatland carbon finance is a relatively new funding source for the land management sector and has the potential to contribute significantly to environmental goals alongside public funding and other sources.

This scoping study brings together information and sets out what is currently known about:

- the developing peatland carbon market and its viability,
- the opportunities and barriers to its development, and
- Natural England's potential role in supporting the development of investment opportunities in peatland carbon finance.

2 Background to the project

2.1 Peat soils resource, its condition and what needs to be delivered

Approximately 1.42 million ha of England is covered in peat soils (HMG. 2021d). This is illustrated in Figure 1. The breakdown against different peatland types ranges according to different source information and some of the data is now getting quite old, as shown in Table 1.

A Peat Mapping project, led by Natural England, will update the soils map and data on peat depth, extent, condition, and impacts. It will report in 2024. It may show that much of what was mapped (Fig.1 & Table 1) as lowland deep peat is now wasted peat. This may have implications for the GHG emissions savings that can be achieved and should be borne in mind when considering the market-level modelling summary in Section 4.5.

Table 1. England's peat resource

Reference key: [1] (Natural England. 2010); [2] (Natural England. 2012); [3] (Evans and others. 2017); [4] (HMG. 2021d); [5] IUCN. 2019.

Type of peat resource	Area (ha)	Additional information
Deep peat	495,828[1 & 5] or 495, 829[2] or 495,858[3]	Peat soil >40cm deep[1].
Wasted deep peat	186,372 [1, 3 & 5]	Wasted peat is heavily degraded by drainage and cultivation for agriculture[3].

Total deep peat	**677,250**[4] **or 679,900**[1] **or 682,230**[3]	
Shallow Peaty Soils	527,200[1]	Shallow peat is found on mineral soil with at least 10cm deep peat cover.
Soils with Peaty Pockets	211,400[1]	Found, for example around flushes (areas of saturated ground).
Total shallow peat	**738,600**[1]	
Total peat soils	**1,418,500**[1]	

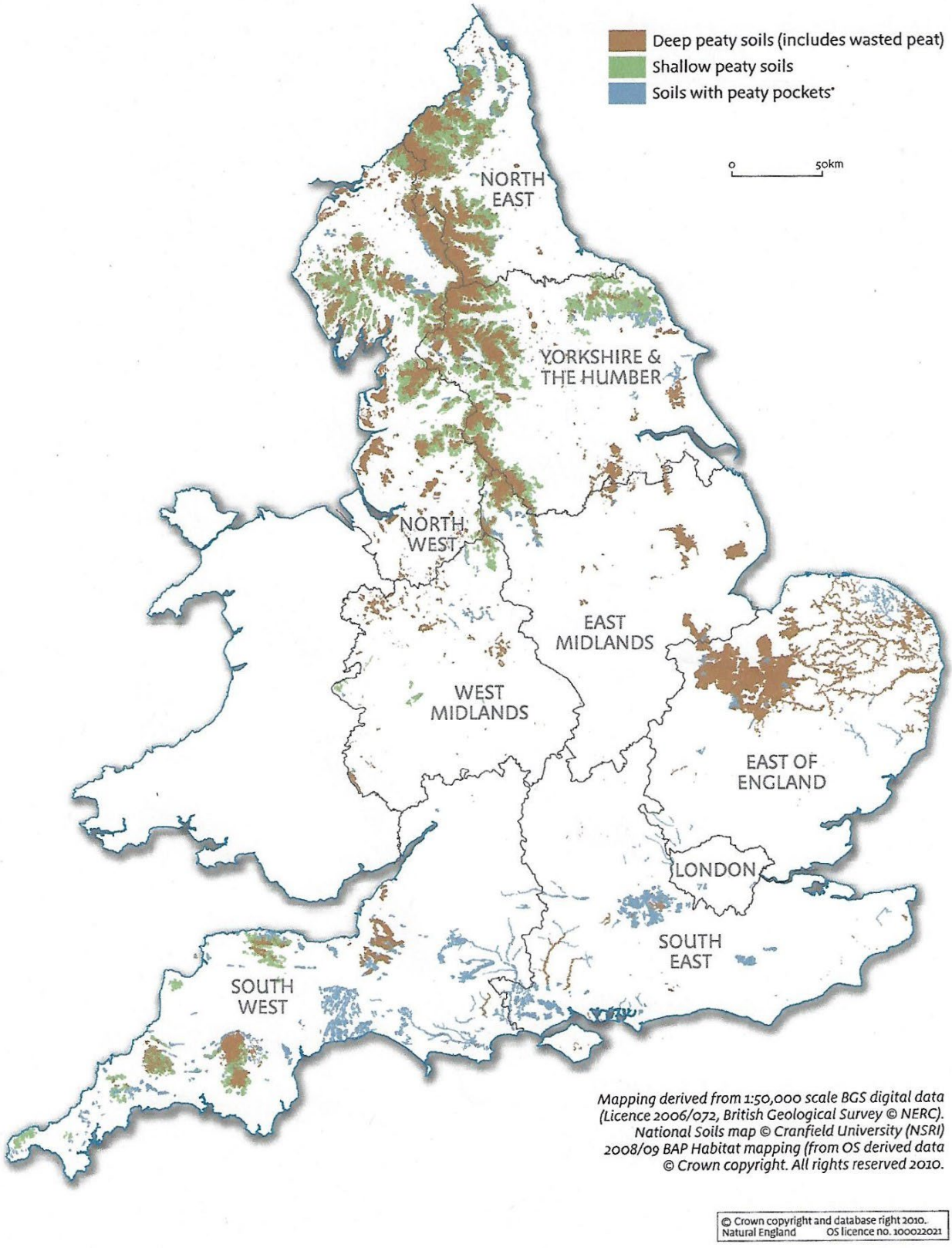

Figure 1. Peat map of England (Natural England. 2010, and HMG. 2021d)

Only 13% of England's peatlands are in a near natural state (HMG. 2021d). Much of the rest of England's peat soil has been affected by human activity resulting in changes to its vegetation and drainage and can shift peatlands to being a net greenhouse gas source (Natural England. 2012). Activities include:

- 75,000 ha of upland peatland has been modified with drainage ditches (known as 'grips') (Natural England. 2010).
- Lowland peatland has been drained for agriculture, particularly for arable crops (Natural England. 2010).
- Drainage combined with historic air pollution, burning and grazing has led to large areas of upland peatland no longer functioning naturally, so that carbon capture, waterflood regulation and the biodiversity of these areas are all sub-optimal (Natural England. 2010).
- Peat soils have been acidified and their nutrient status further raised by the deposition of ammonia (from agriculture) and nitrogen oxide (from fossil fuels) (Natural England. 2010).
- Peat extraction sites covered 9,019 ha of deep peat in 2013, though much of this area is no longer under extraction (Evans and others. 2017).
- Development, including windfarms, has affected about 2% of deep peat (Natural England. 2010).
- Afforestation has affected 5% of deep peat, usually on peatland which was drained before planting (Natural England. 2010).

Degraded peatland systems are more vulnerable to climate change as they are already under pressure, therefore their restoration should be considered a priority (Natural England. 2021a).

2.2 England's restoration of peat soils

Peatland restoration on deep peat has taken place since 1990. From 1990 – 2013 at least 56,953 ha of peatland has been restored on deep and wasted peat (this figure excludes restoration through agri-environment schemes) together with 83,930 ha on deep peat and 2,348 ha on wasted peat which is thought to be in near natural condition (Evans and others. 2017).

Peatland restoration is dependent on two actions:

- rewetting the peatland and
- revegetating the peatland where needed.

Peatland can also be rewetted for agricultural purposes such as paludiculture. Paludiculture is farming with raised water levels (e.g. for certain berry crops, or reed for thatch or biomass) or using seasonally adjusted water tables to allow crops needing drier conditions to be grown.

2.3 Greenhouse gas (GHG) emissions from peatland

GHGs associated with peat comprise of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). GHG is quoted in units of CO_2-eq that includes all three compounds with their differing warming potential. Peat soils emit very substantial quantities of CO_2 when dry or lacking vegetation, due to oxidation of the peat carbon (CEH. 2021).

A bog (rainwater-fed) with the water table no more than 10cm below the surface and a cover of *Sphagnum* moss produces minimal GHG. It will also accumulate peat at between 0.5 and 2mm per year, therefore very slowly sequestering carbon (Natural England. 2021a). Peatland fens (rainwater and surface water-fed) that are managed for conservation appear to effectively sequester carbon. The relationship between rewetting/revegetation and GHG emissions is complex as rewetting may increase methane emissions through the creation of anaerobic conditions. The long air cells in some species that emerge from water, such as common cottongrass (*Eriophorum angustifolium)* transfer methane from their roots to the atmosphere and methane also bubbles up through water (Natural England. 2021a). Nitrous oxide emissions are typically low in natural functioning peats but can contribute significantly to the global warming potential of a bog in systems that are modified for production e.g. croplands (Evans and others. 2017).

GHG emissions reduce rapidly once peat is rewetted (HMG. 2021d). Rewetted and revegetated peatland gives the best chance of abating and sequestering GHG, as well as increasing the resilience of these habitats, in a warming world where evapotranspiration and water availability/quality challenges will increase. A recently published Natural England Research Report 0094 (2021) provides further information.

There is a huge amount of carbon (and potential GHG) stored in the UK's peat soils, mostly in Scotland. Estimates of UK stored carbon vary greatly across various studies between 3.2 (CEH. 2021) to 5.8 billion tonnes (Natural England. 2021a). While these estimated stock values may vary due, in part, to a lack of up-to-date peat depth data, there is a wide consensus that peatland habitats represent our most significant below ground carbon stocks. Ongoing work in Natural England to update the England Peat Map will contribute to increased accuracy in depth estimates (Natural England. 2021a).

Significant updates in the understanding of peat soil GHG emissions data were used in the Climate Change Committee's 6th Report (CCC 2020a). This significantly increased the understanding of the importance of peat in combatting climate change. The CCC reported that 24.5 Mt of CO_2-eq are emitted from UK peatlands each year. About half of that is from England's peat, much of which is drained and used for arable crops and intensive grazing (CCC. 2020b). This data will be further refined as GHG emissions from wasted peat are still being studied; wasted peats are suspected to have lower GHG emissions than deep peat so this may reduce the amount of CO_2-eq that is being emitted.

Of all the habitats, when considering abating GHG emissions, lowland agricultural peat represents the largest opportunity to deliver emission reduction at the scale advised by the CCC report (CCC.2020a).

3 The context for peatland restoration

The context for peatland restoration is dynamic with changing policy and legislation and accelerating peatland restoration delivery.

3.1 The policy context

The policy context has both international and domestic elements. Table 2 summarises the most important initiatives, the areas they cover and how they relate to other initiatives. Further detailed descriptions of the key policy initiatives are provided later.

Table 2. Policy context for peatland restoration

Policy initiative	Aims	Relationship to other initiatives	UK, England or international
Net Zero by 2050	Sets overall net zero aim and timeline.	Policy context for all UK net zero delivery.	UK
Net Zero Strategy	Detail on how net zero will be delivered.	Contains targets and timeline for peatland restoration (England target for peatland restoration).	UK
England Peat Action Plan	Actions in support of peatland restoration.	No detailed peatland restoration targets. Links to restoration in the 25 Year Environment Plan.	England
Climate Change Committee 6th Report	Contains Balanced Net Zero Pathway to decarbonisation by 2050.	Informs government on net zero targets/strategy.	UK
Taskforce on Scaling Voluntary Carbon Markets (TSVCM)	Covers rules of carbon trading – governance, credit integrity.	Paris agreement goal to limit global warming to 1.5 ^{0}C & net zero.	International
Voluntary Carbon Markets Integrity Initiative (VCMI)	Guidance on how carbon credits can be used in net zero reporting.	Influences SBTi and TCFD.	International
Science Based Targets Initiative (SBTi)	Guidance on best practice on net zero target setting and reporting.	Influential in government thinking on environmental reporting.	International
Taskforce on Climate-related Financial Disclosure (TCFD)	Recommendations on mandatory climate-related financial disclosure.	Influences BEIS Green Finance Strategy.	UK
BEIS Green Finance Strategy	Mobilise private capital into environmental investments.	Government policy driver for green finance development.	UK

Government's Environmental Reporting Guidelines (ERG)	Guidance on how carbon units can be reported.	Needs updating with detail on the Peatland Code units.	UK

Net Zero by 2050 and the Net Zero Strategy

The government has committed the UK to be net zero by 2050 (CCC. 2019). To deliver this, in November 2020 the government announced that peatland restoration would be incentivised by the new ELMS and that it would "introduce mandatory reporting of climate-related financial information across the economy by 2025, with a significant portion of mandatory requirements in place by 2023" *(*HMG. 2020*).* The latter will increase interest in how companies report and deliver their net zero strategies. The government's Net Zero Strategy (HMG. 2021b) refers to the 280,000ha of peatland restoration in England.

The UK Government England Peat Action Plan (EPAP)

The EPAP (HMG. 2021d) sets out significant ambitions for peatland restoration and how it will be delivered. The EPAP commits the UK government to secure the UK's peatland carbon store by 2050 in both the uplands and the lowlands. The EPAP (HMG. 2021d) states that peatlands will contribute to the Nature Recovery Network and 25 Year Environment Plan targets of creating or restoring 500,000 ha of wildlife rich habitat. The EPAP contains an aim to drive private investment in natural capital markets and this is dependent on the accreditation and sale of the ecosystems services that peatlands provide. The new Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery Schemes (within ELMS) are identified as providing the main delivery mechanism for peatland restoration after 2024-25.

Climate Change Committee (CCC) 6th Report 2020

The CCC is the independent advisor to the UK and devolved governments on GHG emissions targets and progress towards them. The CCC's 6th Report proposed the Balanced Net Zero Pathway from among a variety of policy options and decarbonisation pathways across 11 sectors of society, the environment, and the economy (CCC.2020a). The Balanced Net Zero Pathway approach combines the need for reducing GHG emissions to net zero by 2050 with other key aims such as maintaining UK food production. The Land Use, Land-Use Change and Forestry (LULUCF) report (CCC. 2020b) is the first time that peat soils have been fully included in the analysis in detail. The report contains some challenging peatland restoration targets to reduce GHG emissions balanced against food production and housing needs. The landowner cashflow analysis and peatland carbon market analysis in Section 4.5 produces various scenarios of upland/lowland peatland restoration based on the CCC report's targets (CCC. 2020a & b) of 100% upland peatland restoration by 2045 and 75% lowland peatland restoration or rewetting by 2050 and scaled back restoration to achieve the net zero strategy target.

There are also several international and UK organisations working to develop standards for climate-related disclosure and establishing how green finance markets will work. These are summarised as follows:

Task Force on Scaling Voluntary Carbon Markets (TSVCM)

TSVCM is an international private sector-led initiative to develop the infrastructure to efficiently scale voluntary carbon markets. It focuses on delivering governance, the legal principles and contracts and carbon credit-level integrity. For example, the TSVCM is developing a set of Core Carbon Principles to label carbon credits that comply with specific quality criteria and attributes to increase buyer confidence. We expect that projects registered with the Peatland Code will be regarded as high quality within the TSVCM typology.

Voluntary Carbon Markets Integrity Initiative (VCMI)

VCMI is an international private sector-led initiative. Its priority is to develop guidance on how carbon units can be used and claimed by buyers as part of credible net zero strategies. Its work will be important as it will help to define how peatland carbon units can be used in climate-related financial reporting. It complements the work by the TSVCM which focuses on the wider market context.

Science Based Targets initiative (SBTi)

SBTi is a partnership between CDP (a non-profit climate-research provider), the United Nations Global Compact, World Resources Institute and the World Wide Fund for Nature (WWF). It advises and promotes best practice in emissions reductions and net zero targets in line with climate science.

Taskforce on Climate-related Financial Disclosure (TCFD)

TCFD is a UK initiative looking at how the BEIS Green Finance Strategy can be implemented. It recommended mandatory climate related reporting and a roadmap towards implementation.

BEIS Green Finance Strategy

The Department of Business, Energy and Industrial Strategy (BEIS) Green Finance Strategy (HMG. 2019b) followed the recommendations of the TCFD. The strategy looks to mobilise and accelerate flows of private finance into key environmental sectors. It covers carbon finance and states that the Peatland Code strongly supports corporate social responsibility investments and has good potential to support offsetting in the future.

The VCMI defines offsetting as when carbon units are purchased to be used as a substitute for emissions abatement when a net zero abatement pathway is not in place for in value-chain[3] emissions (VCMI. 2021).

[3] Value-chain = the supplier-producer-customer relationship.

Note that the government's Environmental Reporting Guidelines (ERG) (HMG. 2019a) states that carbon units registered under the Woodland Carbon Code are recognised for climate-related financial disclosure. However, they cannot be termed "offsets or carbon credits as they do not meet all the 'additionality' tests in common with all domestic emissions reduction projects. (This is related to the UK government policy towards reducing emissions under UNFCCC agreements). This does not mean that it is inappropriate to finance domestic projects; indeed doing so helps the UK to meet its targets efficiently."

The ERG includes Peatland Code units as examples of reportable domestic carbon units for Streamlined Energy Carbon and Reporting (HMG. 2019a); the detailed guidance on how they should be regarded mentions woodland carbon units but does not mention peatland carbon units. This ambiguity is currently being considered by BEIS.

3.2 The legislative context

The Agriculture Act (Legislation.gov.uk. 2020) sets out how land managers in England will be rewarded in the future with public money for public goods such as better air and water quality, thriving wildlife, soil health or measures to reduce flooding or tackle the effect of climate change. ELMS will help incentivise achieving the goals set out in the 25 Year Environment Plan (Defra. 2018) and the commitment to reach net zero by 2050.

Parliament passed the Environment Act in November 2021 (Legislation.gov.uk. 2021b) and it contains two elements that may be significant for peatland restoration:

- **Conservation Covenants** – These are a new option for landowners to commit to managing land in a particular way for a specified length of time. This is expected to help the landowner demonstrate the permanence of emission reductions from peatland restoration and increase the attractiveness of the carbon units to buyers.
- **Biodiversity Net Gain (BNG)** – The creation of a duty for developers to contribute to net gain for biodiversity.

The other main legislative change is the Companies (Strategic Report) (Climate-related Financial Disclosure) Regulations 2021 (Legislation.gov.uk. 2021a) that follows the TCFD's recommendations on climate-related financial disclosure. This will make it mandatory for certain companies to disclose their governance strategy, risk management and the metrics and targets used to assess and manage climate related risks. This legislation will come into force from 6th April 2022 for the first tranche of companies affected. Details of the types of companies that will be affected by the new legislation are in Appendix 4.

3.3 Other context and initiatives

Financing Nature Coalition (FNC)

The FNC is a collaboration of the Broadway Initiative, Green Finance Institute and Finance Earth and has led to the Financing UK Nature Recovery Initiative. It is spearheading the drive to create investable markets and projects for mainstream financial providers to mobilise capital towards nature-based solutions across the UK and leading the thinking about how this may work in practice.

Peatland Code

The Peatland Code (PC) provides a standard for the UK peatland carbon trading market (IUCN. 2017). It is managed by the International Union for the Conservation of Nature UK Peatland Programme (IUCN UK PP). The code is based on the latest scientific understanding of the Emissions Factors (EF) of GHGs from peatland (BEIS. 2021) and is being updated in 2021/22. The code is used to assess the GHG abatement potential of a peatland restoration (the number of carbon units that the site will cease to emit once the restoration is complete). It uses the pre- and post-restoration peat condition category to calculate the GHG abatement over the number of years of the management agreement the landowner has entered with the IUCN UK PP.

The PC demonstrates the environmental additionality that the project will deliver (IUCN.2017). 'Additionality' is an important concept and is assessed to ensure that a project would not have gone ahead in a 'business as usual' (BAU) scenario and that any emissions reductions are 'additional' (see 4.3). A carbon unit is additional if the emissions reduction has only been achieved because of the restoration activity that generated the unit. The code also defines the BAU scenario for the unrestored peatland. As abatement is ongoing once the restoration is complete, the quantity of units generated can be large, particularly for long management agreements.

It also sets standards for the independent validation of the management intervention and the independent verification of the resulting improvements in hydrology and vegetation in the UK. It cannot be used in emission trading as this only applies to land use activities in developing nations. Also, the PC has no mechanism for selling abroad.

Appendix 1 provides an explanation of the Peatland Code, the process for registering and how it manages risks associated with estimating GHG emissions savings and the effectiveness of the restoration.

Current restoration – The Nature for Climate Peatland Grant Scheme (PGS)

The PGS is delivering peatland restoration projects from 2021 to 2025. It is targeting a total of 35,000 ha of peatland restoration by 2025 (HMG. 2021b) and 9Mt of GHG emissions abatement by 2050 (HMG. 2021d and Natural England 2021b). For peat partnerships with advanced project plans, *Restoration* grants will allow quick delivery. For new partnerships or where a planning phase is required, *Discovery* grants will be offered.

Five *Restoration* grants were offered in August 2021 and 10 *Discovery* grants (5 lowland and 5 upland) were offered in November 2021 (Natural England. 2021b).

Lowland peatland restoration projects are particularly welcome as this will bring new peat partnerships into existence, and it is where the greatest GHG emissions savings will be made. Lowland restoration projects are expected to utilise at least 15% of the available funds.

Projects are expected to find 25% match funding (15% may be allowed for exceptional bids) from the landowner, an investor or philanthropic sources (Natural England. 2021b). The match funding challenge is a test of developing market demand.

The scheme is expected to significantly expand the amount of deep peat under restoration (c.5% of England's deep peat) and peat >30cm deep is also eligible. The Peatland Code considers deep peat to be >50cm. The scheme is likely to dramatically increase the amount of peatland carbon units available for sale in the Peatland Carbon Registry.

Future restoration – Natural Environment Investment Readiness Fund (NEIRF)

In recognition that support was needed for an emerging green finance market, government created the NEIRF fund. In July 2021, 27 projects were funded in the first round with at least three peat-based projects and three projects looking at the potential for new carbon codes for other habitats (Natural England. 2021c).

NEIRF supports the business planning stage of the projects. The projects will have to demonstrate their attractiveness to investors to secure the match funding. Many projects will explore the potential to stack and bundle benefits. It may be possible to better understand from the NEIRF projects whether there are efficiencies to be gained from combining projects for larger investors. The second round of bidding for NEIRF has been completed.

Environmental Land Management Scheme (ELMS)

The EPAP suggests that the new ELMS will contribute towards future peatland restoration and maintenance funding (HMG. 2021d). To achieve the CCC's 6th Report's (CCC. 2020a) target of 252,000 ha deep peatland being restored to semi-natural habitats (rather than 124,000 ha to an agricultural end use), ELMS will need to contribute towards nearly 11,000 ha of peatland being restored each year between 2021 and 2044 (HMG.2021b).

ELMS development is ongoing and the conditions and payment rates for peatland restoration and management are being considered. The landowner cashflow and market models (see Appendix 3) confirm that, whilst income from peatland carbon can contribute significantly towards restoration costs, there is a subsequent reliance on ELMS and other sources of income to pay for management costs to maintain the peatland's condition.

Nature Recovery Network (NRN)

Landscape Recovery Projects are being planned with 10 pilot projects starting between 2022 and 2024. They will deliver over 20,000 ha of wildlife-rich habitat including peatland

restoration (Defra. 2022). Delivery will be scaled up from 2024. Projects will be expected to deliver multiple benefits, such as carbon savings to help achieve net zero.

3.4 The state of the current market for peatland and other carbon units

The market for UK carbon units is provided by the UK Carbon Registry which comprises the Peatland Carbon Registry (based on the Peatland Code standards) and the Woodland Carbon Registry (based on the Woodland Carbon Code) (HMG. 2021d). Buyers and sellers register to buy and sell units.

The relative stage of development of the woodland and peatland carbon markets are compared in Figures 2 and 3 below.

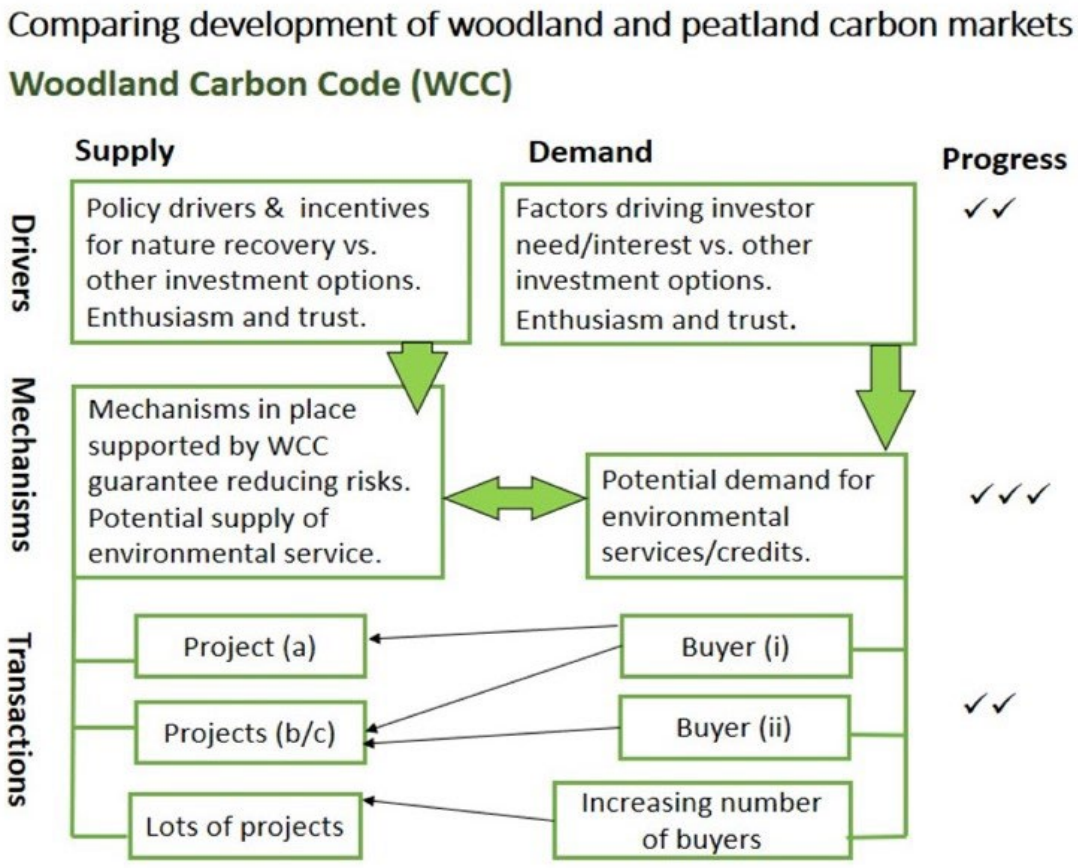

Figure 2. Development of woodland carbon markets (✓✓✓ indicates well developed to ✓ less developed)

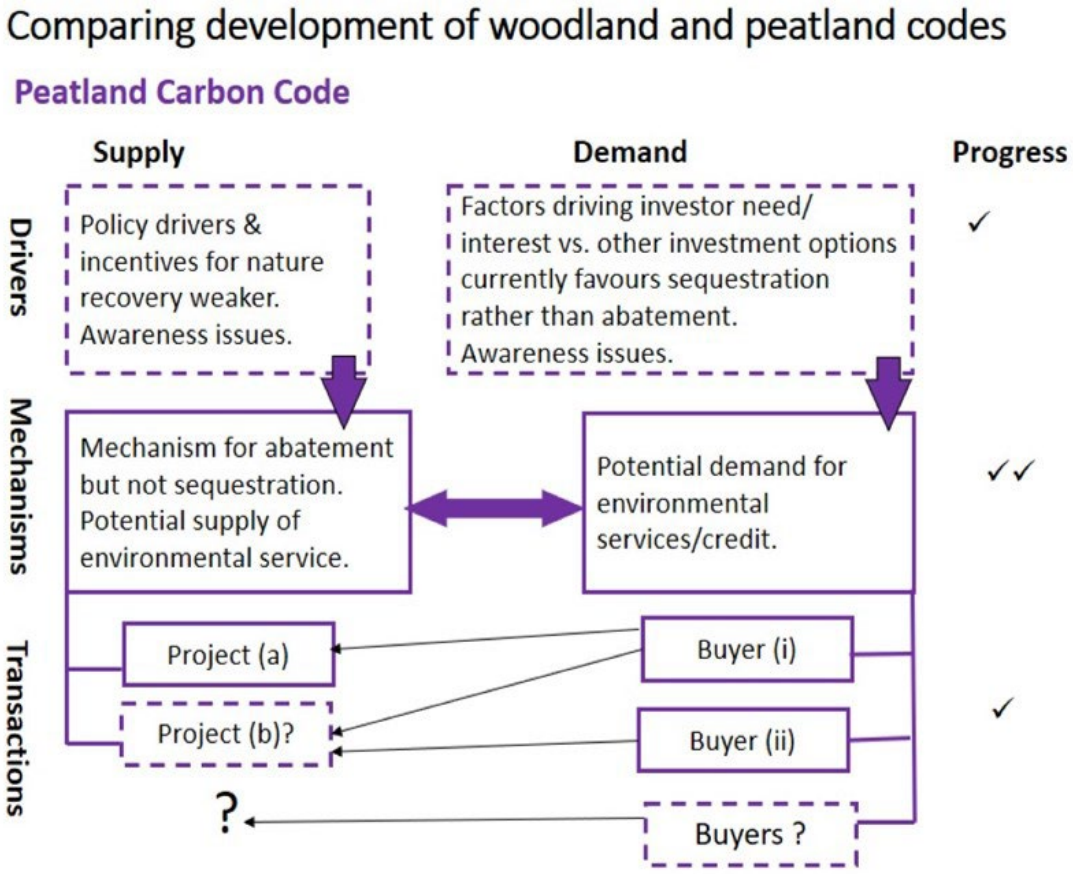

Figure 3. Development of peatland carbon market (✓✓✓ indicates well developed to ✓ less developed)

The Woodland Carbon Registry in 2020 had 969 projects registered and has supported the sale of over 3.1 million Pending Issuance Units (PIUs). PIUs are available to trade once the tree planting has been validated (but before growth rates are verified) and there are a further 1.3 million PIUs available for sale. There is a smaller number of Woodland Carbon Units (WCU) for sale. WCUs are derived from the tree growth verified 5 years after the planting has been validated, and 10-yearly thereafter for the duration of the management agreement.

The Peatland Carbon Registry is more recently established and has 32 registered projects and c.150,000 PIUs for sale. The Peat Grant Scheme is expected to significantly increase the number of carbon units available.

NEIRF is funding three studies looking at the potential of carbon codes for other habitats. These include saltmarsh (through UK Centre of Ecology & Hydrology), farmland & soil (FWAG) and hedgerows (Allerton Research & Educational Trust). Another project is also looking at kelp and blue carbon (Adur District & Worthing Borough Councils). Development of these additional carbon codes will be dependent on sound science on the GHG sequestration and abatement of the habitats.

A functioning carbon market would be expected to consist of a number of potential actors. These are summarised in Table 3 below.

Table 3. The actors in the peatland carbon finance market

Actors	Their involvement
Landowner (Seller)	Owner of the peatland for restoration and the rights over the carbon units. May keep the rights to the units for their own net zero reporting.
Carbon unit buyer	An organisation looking to buy carbon units for its climate-related or other environmental reporting.
Investor	Provider of the private finance. They may be commercial, philanthropical or the landowner or a member of a Peat Partnership. If they are not the landowner, they may seek control of the rights to some or all the carbon units and therefore act as a Broker. Investors can be valuable intermediaries for landowners, particularly those new to peatland restoration.
Broker	A buyer and seller of carbon units. Brokers can be valuable intermediaries for landowners, particularly those new to peatland restoration.
Peat Partnership	A peatland restoration delivery collaboration. Often the lead partner when bidding for public funds. Several are well established; new partnerships are probably needed for lowland peatland restoration.
IUCN UK Peatland Programme	Manages the Peatland Code, the standard for the peatland carbon unit market. Focuses on the scientific standards for verifying carbon emission savings from changes in peat condition category.
IHS Markit	Host of the UK Carbon Registry (Peatland and Woodland carbons). The Registry creates unique carbon credits and provides evidence of their auditable sale and retirement once used for climate-related reporting.
Independent validator/verifier	An accredited organisation that independently validates and/or verifies the peatland restoration.

4 Opportunities and barriers for market development

This section considers the conditions that need to be met for the peatland carbon unit market to function and grow. It also sets out the conditions and the barriers that need to be addressed. Potential solutions to the issues raised are addressed in Section 5.

4.1 Standards for calculation, validation, and verification of peatland carbon units

Standards are important as they apply the underpinning science to provide assurance to buyers and sellers on what is being sold and how it is calculated, validated and verified. The number of peatland restoration projects registering with the Peatland Code is growing,

demonstrating better awareness and that landowner and investor confidence is increasing. Appendix 2 highlights this recent interest through three case studies.

The VCMI sets out five objectives that a standard such as the Peatland Code should deliver. It should:

- calculate robust baselines
- demonstrate additionality
- demonstrate permanence of emission reductions or removals
- address leakage
- ensure an absence of double counting.

The Peatland Code has been designed to achieve all these objectives, with an executive board and advisory panel to ensure transparency. It is being improved to include lowland fen peatland restoration projects, for example.

The costs of registering for the PC, validating restoration and verifying the progress of the restoration must be affordable in relation to the overall costs and income potential. This issue is explored further in Section 4.5. The initial costs for a landowner in using the code relate to building their personal awareness of the code and/or working with partners to develop a restoration project and registering for the code. This can be costly, particularly in terms of landowners' time.

4.2 Landowner interest in peatland restoration and realising income

Snowdonia National Park commissioned a comprehensive review of landowners' attitudes to peatland restoration, the Peatland Code and peatland carbon finance (Taylor, E, and others. 2021). The issues raised by landowners included:

- concern about reduced stock numbers on rewetted peatland and its impact on the viability of grazing
- reversal of the condition of improved (drained) land
- complications with landowner/tenant/grazier/commoner arrangements
- lack of awareness of the benefits of peatland rewetting.

As mentioned above, the EPAP (HMG. 2021d) states that there is a need to promote the benefits of peatland as a carbon sink and a carbon store. These benefits need to be promoted to landowners as well as the wider public, so that changes in the way peatland is managed is seen to have a high societal value.

Woodland creation has a perceived greater value among some landowners and considerable funding for new planting has been committed by government. Timber is a saleable product whose value improves as trees mature to harvestable age regardless of their carbon value. Tree planting on deep peat (>30cm) is not eligible for grants under the new England Woodland Creation Offer (Forestry Commission & Natural England. 2021).

The Peat Mapping exercise will improve the knowledge of the distribution of deep peat and once this data is available it should greatly reduce the risk of planting on deep peat.

Many landowners are unfamiliar with the Peatland Code and its potential benefits. Landowners are aware of the risks of climate change; however they often lack awareness of the importance of peatland for reducing GHG emissions and the need to restore peat. Clearly there is a need to publicise the code and the reasons for restoring peat. The report notes that awareness of the need to restore peatland is demonstrably higher in areas with a history of peatland restoration (Taylor, E, and others. 2021). This demonstrates the value of focused and prolonged project work with landowners. Concerns about the code were noted and these related to the perceived cost of registering with Peatland Code and the cost of site surveys for validation and verification. There is also some resentment that peatland in good condition, including peatland restored prior to the code's availability, is not eligible for registration as it fails the additionality test, i.e. the restoration pre-dates the need for private finance to deliver the restoration.

The landowner's motivations always need to be understood. Their perceptions of the value of the land and its potential use can vary considerably, e.g. grazing, sporting activity, biodiversity, and must be taken into consideration. Well-designed restoration projects and experienced project staff working with landowners are the key to addressing this.

Other landowner concerns include force majeure events such as risk of fire that may lead to a failure of the peatland restoration. The Peatland Code helps to manage this through the Peatland Code Risk Buffer as explained in Appendix 1.

4.3 Additionality tests which must be met to ensure public and private investment

Environmental, financial and legal additionality need to be demonstrated so that landowners, investors and carbon unit buyers can be confident that their investment is secure and subsequent reporting is accurate, thereby avoiding 'greenwash'.

Environmental additionality is demonstrated when an intervention (peatland restoration) is known to cause an activity (reduced GHG emissions) to take place (IUCN.2017). Environmental additionality is calculated by assessing whether a proposed activity is distinct from its baseline, i.e., what would happen if the intervention did not take place. The Peatland Code demonstrates environmental additionality through repeat site survey and scientifically based Emissions Factors.

Projects need to demonstrate financial and legal additionality to register with the Peatland Code. Projects must prove that:

- there are no legal reasons why peatland must be restored on the site (legal test)
- private finance provides at least 15% of the restoration costs (finance test)

- without carbon finance the project shall not be the most economically attractive option for that area of land or shall not be economically viable on that land at all (economic test).

The Peatland Code requires that evidence be produced to demonstrate additionality (IUCN. 2017). Note that if the carbon unit price is too low, more complex restoration projects may fail to meet the financial additionality test (i.e. at least 15% of the restoration costs should be met through non-public funding (Pennine PeatLIFE. 2019)). As mentioned above, the Peat Grant Scheme seeks 25% private finance to encourage the growth of the market and to achieve better value for money for the taxpayer.

4.4 Buyer awareness and interest in the market for peatland carbon units

Landowners can keep their carbon units for their own reporting purposes, or they can sell them privately or through a broker and can choose whether to record their use via IHS Markit.

The Peatland Carbon Registry provides an online and robust means by which verified GHG emission reductions can be converted to uniquely identifiable carbon credits. These credits can be offered for sale, can have their ownership transferred and be 'retired' when they are used for reporting through IHS Markit. Credits offered for sale in the registry cannot be offered in another market; this removes the risk of double selling or double counting.

The Peatland Code and the Peatland Carbon Registry need to be positioned as the leading standard and market respectively for UK peatland carbon. Anecdotally there is evidence of increased buyer interest in the registry. What is not clear is the nature of the demand in terms of customer type, the number of units they may want, the timescales in which they will need units supplying and the price they are prepared to pay.

The comparison between demand for UK-supplied units and demand for non-UK units is also not well understood. Carbon units from non-UK sources are trading around £3-£4 (UCL. 2021). These units from developing countries can contribute to land use activities such as protecting forests and are eligible for emissions trading unlike UK units. Whether the standards that underpin non-UK carbon and their traceability and auditability are of the same quality as UK units is not always clear. The work of the TSVCM in setting Core Carbon Principles to label carbon credits that comply with specific quality criteria and attributes will be vital for buyer confidence.

Despite the lower prices of non-UK units, we know that UK units can be attractive. Woodland Carbon Code units have commanded prices nearer £20 (Woodland Carbon Code. 2021) than the £10-12 for peatland units, although peatland units have recently started to trade at similar higher prices. These similar higher prices are thought to be a result of:

- high buyer confidence in the robustness of units supplied under the codes
- additional buyer benefits through association with a tangible/local project
- additional user benefits where projects can demonstrate delivery of additional environmental outcomes
- the recognition of woodland units in the ERG for reporting purposes.

4.5 Financial viability of peatland restoration from a landowner perspective

As part of the study, landowner cashflow modelling and market-level modelling have been undertaken (Appendix 3).

The **landowner cashflow model** was developed to help understand the finances from a landowner perspective including the impact of registering with the Peatland Code, whether to sell early (Pending Issuance Units (PIU)) or to sell late (Peatland Carbon Units (PCU)), what break-even carbon prices were, and the level of public funding needed to allow the restoration to proceed. It is based on restoring 100ha of either upland or lowland peatland with a 30 year agreement (this is the minimum agreement length for the Peatland Code).

The **market level model** was based on a 75 year agreement (this is closer to an average Peatland Code agreement length) and developed to demonstrate the overall value of the market, the impact of carbon prices, the level of public funding required and how this varies by different types of peatland. The analysis is based on the CCC's 6th Report Balanced Net Zero Pathway's estimate of circa 377,000ha of restored peatland by 2050 (CCC. 2020a), and three additional scenarios have also been provided to fit with the Net Zero Strategy target of 280,000 ha (HMG. 2021b).

More detail on the analysis, the modelling scenarios and the assumptions made are set out in Appendix 3.

Landowner cashflow modelling summary

The model shows very different conclusions for upland and lowland peatland restoration scenarios.

For a typical **upland** peatland restoration project, revenue from carbon unit sale is unlikely to contribute more than 25% to overall project cost, indicating a strong continuing reliance for a high proportion of project cost to be met from other sources (most likely public subsidy). At a 5% discount rate the net present value of cashflows is similar if sold as PIUs or PCUs but use of PIUs is much more manageable for landowners who have illiquid assets and/or have difficulty accessing upfront finance to fund the restoration work. Access to upfront finance could still be a significant barrier for such landowners, but this could be overcome if a short-term loan mechanism were available, with payback (based on PIU sale) within 1-2 years. The longer-term cash risk associated with sale as PCUs would warrant consideration of some form of Peatland Carbon Guarantee. This would need to be set at approx. £25/unit (alongside a 75% grant from public funds) to secure

landowner confidence. A loan or guarantee scheme for PIUs would be much less expensive and with much less long-term risk for government; the purpose would be to simply give the cash-poor landowner confidence to borrow for 1-2 years only.

Compared to upland peatland projects, **lowland** projects typically have higher restoration costs per ha but generally higher potential for GHG emissions reduction. As a result, carbon finance has the potential to make a much more significant contribution to overall restoration costs but with a much greater cash-flow impact, due to a higher dependency on carbon unit sale as a funding source. Even for relatively complex/costly lowland restorations, carbon finance could contribute 50% of restoration costs, and this could easily reach 100% on less costly projects. For example, a project with a restoration cost of £5000/ha could be financially viable (with no public subsidy) at a PIU price of only £9/t on a 30 year management agreement, this would drop to £3.50 on a 75 year agreement.

The bigger financial challenges for lowland peatland restoration are with cash-flow, the need to address income forgone (where land is taken out of intensive agricultural use) and the need to fund the higher costs of ongoing maintenance. The Nature for Climate Peat Grant Scheme (Section 3.3), currently in operation, is designed to provide a 75%-85% contribution to restoration costs. This works well in support of an upland restoration project, but the emphasis for public funding for lowland restoration is likely to need to be different, with the option for a lower percentage grant contribution to upfront costs, supported by a facility to provide a short-term loan or price guarantee. ELMS will then have a key role to play in addressing income forgone and ongoing maintenance costs post restoration. Other changes in the way public funds could be deployed include a change in geographical focus for public funding of restoration towards areas that are less attractive to private investors, e.g. where the opportunity to “bundle” with other benefits is lacking, where projects are more complex or contentious and the risks are higher or where GHG abatement is less certain.

As the contribution that private finance is expected to make to peatland restoration grows, there is going to be an increasing number of landowners who face cashflow challenges. The EPAP states that the idea of Peatland Carbon (price) Guarantee will be explored (HMG. 2021d). The existing Woodland Carbon Guarantee is a reverse auction approach, whereby the government guarantees an index-linked price for verified Woodland Carbon Units (WCUs) every 5 or 10 years to 2055-56 (Forestry Commission. 2021). Landowners are not obliged to sell the WCUs to the government and will probably choose not to if the market price is higher than the price agreed at the reverse auction. The Woodland Carbon Guarantee does not contribute to tree planting and establishment costs but offers a predictable income for maintenance. It aims to build landowner confidence in tree planting on land where alternative land uses are possible.

Another option is to make loans available to landowners that could be repaid when PIUs are sold.

The report for Snowdonia National Park (Taylor, E, and others. 2021) also contained landowners’ opinions on finance and supports the findings from the landowner cashflow modelling. The financial issues raised by landowners mainly related to:

- the compatibility of peatland restoration with agri-environment income
- loss of land value and grazing income
- tax implications of restoring peatland
- peatland restoration costs and the cost-effectiveness of peatland carbon finance with high restoration costs and long financial return periods.

ELMS agreements and income must be compatible with peatland carbon finance agreements. There is a perception that rewetted peatland will support fewer grazing animals so stocking rates may need to be considered when designing ELMS.

Market-level modelling summary

The Net Zero Strategy (HMG. 2021b) contains a target of 280,000 ha of peatland restoration for England by 2050. The strategy is not prescriptive as to whether that will be achieved in either the uplands or lowlands, or by peatland category (bog, fen, peat extraction site, etc). The CCC 6th Report (CCC. 2020a) provides a useful methodological basis for understanding the market; it includes targets for upland and lowland restoration based on the actual areas of peatland categories and their associated emissions factors. These figures, assumptions and the same modelling approach have been applied to the Net Zero Strategy restoration target. A range of scenarios have been provided in Appendix 3: one is based on the CCC 377,000 ha; three have been produced to match the Net Zero Strategy 280,000ha. These later three consist of: Scenario 1 which is the CCC approach scaled to the lower 280,000 ha; Scenario 2 considers that most of the restoration will be in the uplands; Scenario 3 with most of the restoration in the lowlands.

Based on the Net Zero Strategy target of 280,000ha, peatland restoration could provide between 1.58 million and 3.51 million peatland carbon units to the market (Appendix 3). With a Pending Issuance Unit price of £11.50, that gives a discounted market value of £649 million to £1,418 million between now and 2056. For all three Net Zero Strategy scenarios examined the income figures make a significant contribution to the restoration costs. This varies according to peat type, with a relatively low potential contribution (ca 25%) for upland peatland restoration and a much higher contribution (>50%) for lowland.

The market-level modelling confirms the landowner cashflow model findings that upland restoration needs most of its restoration costs to be met by public funds. It also showed that restoring lowland grassland and cropland created large numbers of carbon units so that public funding for restoration costs for these habitats could be substantially reduced. This supports the findings of the landowner cashflow model. Indeed, for cropland conversion, there is the potential for carbon revenue to not only fully fund the restoration cost, but also to contribute substantially to ongoing maintenance costs.

Carbon finance in relation to other non-exchequer funding options

PGS applications. for which there is a 25% match funding requirement, have provided examples of alternative options to secure non-exchequer funding for peatland restoration which could, potentially, work alongside or as an alternative to carbon revenue in future

projects. This match funding can be philanthropic, from landowners, other members of a Peat Partnership, grant and trust fundraising or sourced commercially.

Substantial match funding has been found on projects to date from members of Peat Partnerships (water companies) and from non-Exchequer funding bodies such as National Lottery Heritage Fund (NLHF) and EU LIFE. Water companies have been interested in multiple benefits from peatland restoration, e.g. water quality improvements and biodiversity. Bundling is already operating therefore and at least one English study has been published showing multiple benefits from peatland restoration including water quality improvements (HMG. 2021d).

Some landowners and Peat Partnership members have been keen to retain rights to the units. These units are therefore not available in the Peatland Carbon Register – this may be because they want to use these units as a contribution to their own GHG reporting and net zero aims.

Stacking and bundling of environmental benefits to access additional funding sources

Stacking and bundling refers to the selling of peatland carbon units and other environmental benefits such as biodiversity or water quality from the same restoration. Benefits can be stacked (sold separately, possibly to different buyers) or bundled (benefits sold together to one buyer with one primary validated and verified benefit) (Financing UK Nature Recovery. 2021). Both options are potentially attractive to sellers as income should increase. Both approaches also value a wider range of ecosystem services more accurately; this is important to the environment sector where services are usually under-valued, if indeed they are valued at all.

For both stacking and bundling there are risks from the increased complexity of auditing the sales: reporting using what could become complex and hard to differentiate credits, both at the corporate and national scale; and the loss of clarity and confidence among buyers in what they are purchasing if the credits are too complex.

Transactional costs will also rise, particularly for stacked credits e.g. validation and verification costs will rise, because each component of the stack needs to meet the relevant standards for that market. Bundling is less prone to reporting risk and lack of clarity over which credits are being offered, as selling bundled credits and only having to validate and verify the primary benefit is generally simpler.

There may be a marketing advantage to bundling where peatland restoration is sold as the primary benefit alongside biodiversity, landscape, social and water quality benefits, etc., in the bundle. Restoration that delivers these additional benefits is sometimes referred to as ‘charismatic carbon’ (BusinessGreen. 2019). However, once other outcomes are incorporated and sold to a single buyer as part of a bundle, these are then no longer available to be disaggregated and sold at a later stage as a stack.

If stacking is to work, distinct outputs which result from the intervention (i.e. the restoration to create a functioning bog) are required. The outputs, such as reduced flood risk and cleaner water, need to be quantified (against the baseline to demonstrate additionality). Carbon buyers can be wary about stacking and the legal additionality test; they need to be assured that the intervention their contribution is paying for is not a legal obligation. Therefore, each component of a stack needs to meet its own scheme additionality requirements. The timing of the sales of the benefits probably also needs to be coordinated to maintain auditability. Reputable registries to track ownership and the sales and the retirement of units from multiple outputs are needed for stacking.

In principle, the areas where stacking may be viable as a means of generating additional funding for peatland restoration include:

Biodiversity Net Gain (BNG)

From 2023, BNG is mandatory under the Environment Act (Legislation.go.uk. 2021b). The spatial hierarchy principle means that most habitat will be delivered on site or within the local planning authority area. There is some wider scope for BNG to support peatland restoration through habitat banks or the government's statutory biodiversity credits scheme where developers can buy credits for landscape-scale projects.

The peat-based BNG pilot landscape-scale project is Chat Moss, Manchester. Business planning for the pilots started in 2020 for 2024 delivery. Note that due to the spatial hierarchy approach in BNG and the additionality criteria (which require the BNG payment to meet the full cost of generating the BNG unit), contributions to peatland restoration are likely to be limited, with little opportunity to stack BNG alongside carbon revenue. Peat soils near towns and cities, such as Manchester, may be in the best position to deliver peatland restoration from BNG.

Flood Risk Management (FRM)

Peatland restoration in upper catchments as part of 'slow the flow' (Environment Agency. 2015) FRM projects are thought to be the most likely benefit that could be combined simply with peatland carbon units. Lowland FRM projects will be complex and expensive and can have wider implications, such as competing land uses.

Water quality improvement

Water companies with upland catchments have a long history of supporting peatland restoration for water quality improvements. In the lowlands partnerships such as the Somerset Levels Catchment Market are being set up to trade nutrient credits and the Solent Nutrient Trading Platform is in development. These lowland schemes aim to improve the condition of designated water bodies and in some cases facilitate development through the improved management of catchment nutrient budgets. This can take the form of changing the management of agricultural land to reduce nutrient loads in waterbodies. How peatland carbon finance may integrate with the economics of these projects will become clearer as they progress.

There are other benefits created by restoring peat, such as biodiversity enhancement and landscape improvement, but many of these benefits do not have an easily realised market value in a credit-trading system.

4.6 Buyer satisfaction with the suitability and price of peatland carbon units

Carbon unit buyers need clear information about what they can use carbon units for and how they can be reported and must be assured that the units are of the appropriate standard. Net zero policies must prioritise the decarbonisation of activities in an organisation's value chain. SBTi guidance, as recently updated, recognises that achievement of a net zero target may need to include 5-10% from 'offsetting' (Science Based Targets. 2021), with reference made to woodland carbon but not peatland. Carbon units from peatland restoration and woodland planting cannot, however, be reported as "offsets" or "credits" under the UK government's ERG, although investment in these activities is nevertheless recognised as making a valuable contribution to GHG reduction. Based on the current science, peatland carbon units are generated by the net abatement of GHG emissions and not the sequestration of GHG from the atmosphere (HMG. 2019a). This creates an issue when setting standards for buying carbon units because an abatement unit does not cancel the impact of a value-chain GHG emissions, whereas a sequestration unit does. However, a focus only on GHG sequestration units would not address the issue of GHG emissions from drained and bare peat, so there would remain a societal-level cost from favouring sequestration projects and not peatland restoration projects. The ERG does allow the inclusion of sequestration units when calculating net emissions but does not mention abatement units. The VCMI is aware of this issue and is consulting on a proposal for organisations to be able to include what it terms 'Mitigation Contributions' in organisational reporting (VCMI. 2021).

Currently therefore peatland carbon units are recognised in the Corporate Social Responsibility (CSR) market but not recognised in compliance markets such as the UK Emissions Trading Scheme (HMG. 2019a).

Compliance markets are "markets created through legal obligations or mandates on entities to cover their emissions with carbon assets, such as offsets or allowances". CSR markets are one part of the voluntary carbon market. Voluntary carbon markets "refer to voluntary compensation or offsetting undertaken by corporate entities, the social sector, or individuals looking to compensate their carbon footprint, without any legal mandate" (World Bank Group. 2016).

What sets the CSR market apart from the rest of the voluntary market is the lack of clear recognition in environmental reporting systems, e.g. the GHG abatement units created by the Peatland Code are not referred to in the same way that Woodland Carbon Code units are in the government's ERG.

From April 2022, approximately 1600 UK companies will be required through the 'Companies (Strategic Report) (Climate-related Financial Disclosure) Regulations 2021'

(Legislation.gov.uk. 2021a) to make new climate-related financial disclosures (see Appendix 4). This will include reporting on governance, strategy, risk management and metrics and targets; the company's own net zero plans in other words. This will potentially increase the demand for peatland and woodland carbon units and will certainly increase the need for robust seller and buyer standards. The setting of net zero targets (which include supply chains), alongside the increased disclosure requirement, also has the potential to drive an increase in investment in peatland restoration which will affect some landowners directly (where they have net zero targets in their own right) or indirectly (as suppliers to large corporates), The work of the TSVCM on market structures and rules, the VCMI on carbon market integrity and the SBTi on net zero reporting will need to be at an advanced stage to enable organisations to report and trade with confidence.

Conservation Covenants (Legislation.gov.uk. 2021b) can be expected to be of value to carbon buyers as they contribute towards one of the VCMI's criteria, namely demonstrating the permanence of emission reductions or removals. However, long duration commitments on land management may not be attractive to landowners, particularly when ELMS is in development and the NRN approach is also new.

4.7 Investment opportunities for different carbon unit buyers and investors

Based on the CCC's Balanced Net Zero Pathway scenario, and using the 280,000ha of the Net Zero Strategy, with some conservative assumptions the potential market value from English peatland restoration could be up to £1.4bn. This is likely to make the market attractive to large investment organisations whose demands may be quite different to those looking to invest or buy carbon currently.

The Financing UK Nature Recovery (2020) identified 5 stages that markets typically progress through to achieve Capital Investment.

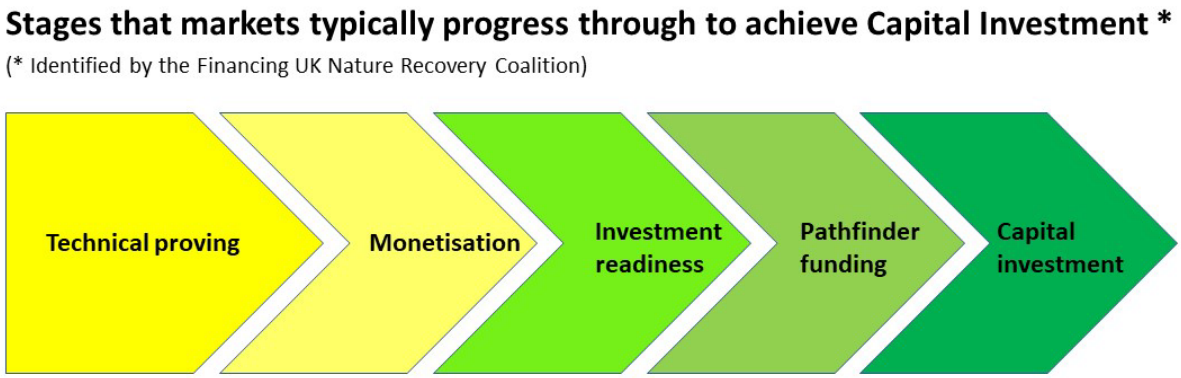

Figure 4. The five stages to achieve capital investment

1. Technical Proving - shows that the intervention is deliverable and that science-based standards demonstrate reliable delivery.

2. Monetisation - involves identifying potential buyers of the services and establishing their willingness to pay. A clear demonstration that the environmental delivery will meet the regulatory requirement is needed.
3. Investment Readiness - demonstrates that cash flows and project structures work, that the risks are understood and that the potential returns required to attract investment are available. Pioneer buyers of environmental services need to commit at this stage.
4. Pathfinder Funding - markets need to be demonstrated at investment scale and this requires what FNC refers to as ‘patient capital/low-cost finance’ to support project development and project aggregation.
5. Capital Investment - capital investment at scale will happen as markets establish. With the policy and legal drivers rapidly advancing, the potential for environmental market growth is strong.

The environmental sector has started developing insight into the likely demand for peatland carbon units. High net worth individuals and private offices may be more interested in impact investing in the biodiversity-based green finance market (Investment Readiness stage); institutional investors are perhaps more likely to follow at the Capital Investment stage (RSPB. 2018).

The PGS and NEIRF projects both provide learning opportunities about investor and peatland carbon buyers in the Technical Proving, Investment Readiness and Pathfinder Funding stages. Environmental impact investors are responding to opportunities created by the PGS and NEIRF; they are combining with environmental groups to create opportunities to offer peatland carbon for sale, along with other environmental benefits, e.g. ‘Wilder Carbon’ with the Sumerian Foundation (Wilder Carbon. 2021) and ‘Net Zero with Nature’ Revere project with the help of Palladium (National Parks UK. 2021).

For investment opportunities to grow, peatland restoration will have to provide a large and predictable supply of carbon units to the market. The units must be available to potential buyers in the numbers they require in investment opportunities they can understand and access easily.

Carbon units are available for sale at the project scale in the Peatland Carbon Registry which creates a single buyer to single seller market; brokers can aggregate units from projects to make larger offers for buyers. What is not clear is whether aggregation to a much larger scale is required for the large institutional investors. This approach will bring economies of scale which may appeal to larger investors and may appeal more to buyers who are less attracted to the idea of ‘charismatic carbon’. Large, aggregated investment opportunities offer anonymity to buyers and sellers which may help reputational management issues for some market participants.

5 What needs to happen for the market for peatland carbon finance to develop?

This section considers the actions needed for peatland carbon finance to develop, in relation to each of the barriers set out in section 4:

5.1 Standards for calculation, validation and verification of peatland carbon units

The Peatland Code is attracting increased interest and a growing number of registered projects (Confederation of Forest Industries. 2021). The code is being expanded to include more peatland restoration types e.g. fen which will make it an attractive option for lowland peatland restoration projects funded by the PGS or emerging from NEIRF. The evidence base for Emissions Factors for the restoration of forest-to-bog needs improving, so this will take longer. The code is also being aligned with the government's 'Emissions Inventory' (HMG. 2019a) and that will make the reporting of GHG emissions savings easier at a project, carbon buyer and national level. The Peatland Code's science, its accessibility to users, its costs and ease of use are currently being reviewed by Defra.

Apart from the improvements to the code, raising awareness of peatland restoration and the existence of the Peatland Code is probably the main priority. The monitoring of the number of registrations and units for sale and actual sales on the Peatland Carbon Registry over the next five years will be informative.

5.2 Landowner interest in peatland restoration and realising income

Promoting the benefits of peatland restoration to landowners and raising awareness of the market for peatland carbon is acknowledged in the EPAP (HMG. 2021d). Given the history of peatland restoration, awareness is highest in the uplands. One of the main aims of the PGS, NEIRF and NRN projects is to increase the number of projects in the lowlands. Running successful projects with peer-to-peer learning opportunities for landowners and their advisers are likely to be effective means of raising awareness of peatland restoration.

Landowners will need assurance that they will not lose out on future agri-environmental payments if they restore a peatland now.

A marketing strategy for the Peatland Code could be productive. Making available the lessons learnt by the Peatland Code to other developing carbon codes being considered through NEIRF will be valuable.

5.3 Additionality tests which must be met to ensure public and private investment

Additionality has been considered in the design of the Peatland Code. Projects registering for the code will have to deliver a high standard of proof that the environmental, legal, financial and economic tests are met. This should be straightforward for upland sites where alternative land uses are largely non-existent. It may require more complex evidence for some lowland restorations where wider policy considerations, e.g. flood risk management, and other land uses, e.g. transport infrastructure, exist.

5.4 Buyer awareness and interest in the market for peatland carbon units

Research into buyer awareness of and interest in the peatland carbon market is needed. The pro-active commissioning of research is likely to be a more productive exercise than waiting for buyer interest in the Peatland Carbon Registry.

How the UK carbon market and the non-UK carbon market compare should form part of that research. What factors influence whether carbon is sourced from the UK or not is likely to be complex with the availability and timing of supply, the price and the suitability of credits for climate related financial disclosure all likely to be important issues.

5.5 Financial viability of peatland restoration from a landowner perspective

Financial viability for landowners is dependent on all income streams being accessible and compatible, that income must match costs, and that cashflow issues must not be off-putting.

Payment rates that are sufficient to meet restoration and management costs when matched with private finance need to be considered in ELMS design. Private finance will probably make a larger contribution towards landowner income in lowland restorations as the number of carbon units is so much larger. There is more to be understood about lowland peatland restoration as multiple sources of public funding could be needed, e.g. flood-risk management and ELMS. ELMS funding for peatland restoration and management will have to be available from around the time that PGS funding is ending to ensure the continued delivery and likely increase in the rate of peatland restoration. ELMS design may consider whether there could be options for the proportions of public funding available for different restorations.

Stacking and bundling also presents challenges. Defra is leading the discussion about developing guidance for stacking and bundling which should be available in 2022. The guidance will be timely for projects under development in NEIRF. The main risks for stacking and bundling are demonstrating environmental additionality (clear, separate

outputs for each environmental benefit) and financial additionality (confirmation that all the funding is needed for the project and all income clearly links to items of expenditure).

The NEIRF will hopefully provide examples of stacking and bundling for evaluation. Projects where income sources could be stacked or bundled, e.g. peatland carbon finance/flood risk management and ELMS funding will need wider consideration by Defra and its arms-length bodies.

5.6 Buyer satisfaction with the suitability and price of peatland carbon units

This is an area where understanding will develop considerably in the next few years. Peatland carbon lies in the Corporate Social Responsibility market and buyer attitudes to this are not well understood. Buyer attitudes to the Peatland Code are also not clear although hopefully the scientific basis of the code is considered robust. Sales of peatland carbon privately and use of the code and Registry should be monitored. Understanding the nature of the buyers, the scale of demand and the prices achieved will be important. Forestry Commission Scotland has already looked at the wider benefits of the Woodland Carbon Code (Eftec. 2016). A study of demand for CSR carbon and buyer attitudes to the Peatland Code could be productive.

The inclusion of the Peatland Code in the government's ERG would help ensure that buyers will increasingly recognise the code as the accepted standard.

The changes to the legislation for the climate-related financial reporting are likely to be significant. There will be an increase in demand for carbon units with the potential for trading and reporting. The duty to make climate-related financial disclosures is likely to be widened to include more businesses. The work being delivered by the VCMI and SBTi will be very timely in shaping how this reporting works. The ERG will have to be updated in light of the work of the VCMI and SBTi.

Natural England is managing a pilot project studying Conservation Covenants for the first 3 years of their existence (2022-25). Conservation Covenants present unknowns in terms of the scale of demand so Natural England will use their early stages to assess their implications, which could be considerable if demand from carbon buyers is high.

5.7 Investment opportunities for different carbon unit buyers and investors

The market for investment and carbon purchase is evolving rapidly. The market is best described as being in the early part of the investment readiness stage as cash flows are being demonstrated and investors attracted.

Given the potential size of the market and the need to meet what could be sizeable demand, the priority is to ensure a supply of peatland carbon of nearly 11,000 ha a year once the PGS finishes in 2025. This will require close cooperation between ELMS design,

NRN Landscape Recovery projects and successful projects from NEIRF. If this is achieved, there is a reasonable expectation of growing interest from private finance.

6 Conclusions and recommendations

The conclusions and next steps can be split into supply and demand side issues.

6.1 Supply side

To achieve peatland restoration and to supply the market with large numbers of high-quality carbon units, public funding for peatland restoration must be available at a suitable scale and time. The next step is to ensure that ELMS design considers how it may be designed to work with private finance.

The Peatland Code is a robust basis for validating and verifying carbon units (IUCN. 2017) and is being improved. The code should be scientifically compatible with any emerging buyer standards for corporate climate-related financial reporting. The next steps are for Natural England to continue to support the development and uptake of the Peatland Code and to support the inclusion of Peatland Code abatement derived units in climate-related financial disclosure. To ensure that land managers are getting the best support and advice it is important that there is sufficient staff capacity within IUCN UK PP, and capacity/training for land management advisers within NE (and other government agencies).

Cashflow issues will be significant for ‘cash-poor’ landowners wishing to restore peat. A Peatland Carbon Guarantee could be developed if landowner need is demonstrated. Accessible loans may be another option for lowland peatland restorations. The next step is to use the landowner cashflow modelling to examine the case for a Peatland Carbon Guarantee and maybe accessible loans for peatland restoration.

Financial modelling shows that the 75:25 public: private funding mix could be altered for lowland peatland restorations as the number of carbon units is large. However, public funding for peatland restoration will continue to be needed. The next step is to consider how the public: private funding mix may be altered for lowland peatland restorations. This will require more market information.

There is a need to promote messages about the requirement to manage peatland differently for climate change adaptation purposes. Messaging about lowland peatland restoration is particularly necessary due to competing land uses. Natural England needs to support Defra and partners in influencing thinking about peatland and climate adaptation.

Multi-benefit projects emerging from NEIRF and the NRN will create opportunities for stacking and bundling of benefits that should demonstrate the potential of the approach. The next step is for Natural England to monitor the development of stacking and bundling in PGS and NEIRF projects.

Landowners' priorities, particularly if they have their own net zero policy, will influence the demand for peatland restoration. The next step is to better understand the likely extent to which landowners will, in future, recognise this as an investment priority. There is also a need to provide some sort of recognition and possible incentive for landowners who have already restored or maintained peatland in a good condition.

6.2 Demand side

The scale and timing of the demand for peatland carbon units needs to be understood, so that peatland restoration delivery can be appropriately managed. This is important given the lead-in time required for peatland restorations. The next step is for Natural England to work with partners to understand the timing and scale of development of the peatland carbon finance market. This should be quantitative analysis on the scale of the demand and qualitative based on conversations with buyers.

The Peatland Code and Peatland Carbon Registry must be promoted to carbon buyers as they make good-quality carbon units available for sale in an accessible and reliable market. Natural England has a role to play advising and supporting the development of the code and the Registry whilst ensuring that they remain affordable and appropriate for use. Natural England should work with partners to understand how the code and registry are valued and used by buyers and use the feedback to improve them.

Emerging climate-related financial disclosure standards must be understood and influenced, so that that peatland carbon units are known to be compatible with demand. Natural England will support government in valuing abatement-derived units in the government guidance on climate-related reporting.

The path to investment readiness is likely to be complex and of a scale and nature that Natural England has not taken before. For example, the aggregation of peatland carbon from several projects may be required to meet the requirements of institutional investors. Natural England will continue to work with Defra, the Financing Nature Coalition and project delivery partners to understand whether investment opportunities need to be scaled-up and how that may be achieved. Some research among peatland carbon buyers is likely to be productive.

Further work is needed to gauge the likely demand for a Peatland Carbon Guarantee. Natural England will work with Defra to consider whether accessible loans for peatland restoration may be needed.

This report was written to provide an understanding of the peatland carbon finance's emerging market and to bring information together in one place. It identifies the issues that need to be addressed if the opportunities are to be realised. This section has set out some of the steps that need to be taken. While Natural England can address some of these issues, action is needed by others.

The 2021 Autumn Budget Statement mentions that funding provided in the budget and spending review will improve the natural environment and support the goals of the 25 Year

Environment Plan while making a vital contribution to carbon emissions targets. Significantly, it includes “setting an ambitious new target to raise at least £500 million in private finance to support nature’s recovery every year by 2027 in England, raising to more than £1 billion by 2030” (HM Treasury. 2021). This announcement, made when finalising this report, provides a commitment to removing or addressing some of the barriers and sets a baseline for expected timescales.

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Appendices

Appendix 1 - The Peatland Code and the Peatland Carbon Registry

The Peatland Code is a voluntary certification standard for UK peatland restoration projects to access environmental finance managed by the IUCN UK Peatland Programme (IUCN. 2017). The emission factors (how much GHG is emitted from a hectare of peat soil per year) set out in the Code represent verifiable and validated figures and it is the only recognised scheme for purchasing and reporting carbon units in UK peatlands. The Peatland Code differs from the Woodland Carbon Code, in that emission estimates are based on the condition of the peatland before and after restoration and represent avoided loss or reduced emissions (abatement), rather than active sequestration. Emission factors are based on a combination of data reported in the UK relevant literature and IPCC default values and are being updated in 2021; this will allow the code to be applied to lowland peatland categories such as fens. The Peatland Code provides estimates of the net effect in GHGs of moving from one condition to another, e.g. from bare, drained peat to e.g. rewetted and vegetated peat.

The Peatland Code manages risk by:

1. Managing scientific imprecision by subtracting 10% of the predicted carbon units from the total; and then
2. Allocating 15% of the carbon units to the Risk Buffer to account for restoration failure or under-delivery. (The net effect of this and the previous multiplier is that 76.5% of the predicted units are available for sale).
3. Avoiding the double-selling of units by carefully identifying and mapping restoration sites and demonstrating ownership and management credentials as part of the project registration process.
4. Avoiding the double-counting of carbon units by off-setters as IHS Markit issues identifiable carbon units and issues certificates of ‘retirement’ when they are reported against. The Registry also only allows unique ownership of the units. (This also helps host countries avoid double-claiming the carbon units in their national net zero reporting).
5. Only using an independent and accredited Validator/Verifier.
6. Carrying out verification surveys for a minimum of 30 years to capture the progress to near-natural ecological and hydrological functionality (converting PIU to PCU).

The Peatland Carbon Registry allows for the buying and selling of UK-generated units within the UK (HMG. 2021d). The Registry gives users a unique identifier and converts a verified carbon reduction into a saleable emission unit. The system then enables the transfer of credits between sellers and buyers. Finally, customers can retire their credits allowing an account holder to illustrate that the necessary credits have been purchased

and removed from circulation. Projects must have registered with the Peatland Code and must not offer units for sale elsewhere.

Table 4 The twin track approach to registering peatland and making available to the carbon market

IUCN UK Peatland Programme	IHS Markit Peatland Carbon Registry
The landowner registers the project with the Peatland Code.	Carbon unit seller, buyer or broker registers with the Registry. Brokers can create an account or sub-accounts for clients.
The project site is surveyed to record the extent and the condition of the peat.	
A site restoration plan and a GHG 'assertion' (GHG abatement prediction based on the site survey) are prepared.	The Restoration Project details are entered in the Registry by the Validator for validation, e.g. location, area, peat condition extent, GHG abatement prediction.
Third party validates plans, The Validator uploads the map of site, Carbon Calculations, Project Design Document) and the Validation Statement to the Registry	**Third party validates plans, The Validator uploads the map of site, Carbon Calculations, Project Design Document) and the Validation Statement to the Registry**
Restoration work must be complete within 3 years of Project Validation.	**Restoration work must be complete within 3 years of Project Validation.**
The restoration work is completed and surveyed by an independent and accredited Validator.	The Validator uploads the Restoration Validation Statement to the Registry. IUCN UK PP and then IHS Markit approve documents ('Restoration Validation').
Restoration Validation must take place within one year of the completion of restoration works.	**Restoration Validation must take place within one year of the completion of restoration works.**
Verifications of the restoration 'in progress' at Year 5 and every 10 years thereafter by an independent, accredited Verifier to record extent and condition of the peat. For the duration of the management agreement between the landowner and the IUCN UK PP.	The account holder updates the Registry with the data the Verifier has supplied. The Verifier uploads their Progress Report, Monitoring Report and Verification Statement and approves the conversion of PIUs to Peatland Carbon Units (PCUs). IUCN and then IHS Markit approve PIU/PCU conversion. PCUs can be traded or used for reporting and retired. Adjustments for under- or over-delivery of PCUs can be made, dependent on the success/failure of the restoration as reported by the Verifier.

(Note - Text in **bold** are shared actions).

Appendix 2 – Case Studies

Pat Wilson Farms, Lochrosque Estate, Wester Ross, Scotland

This family-owned estate is a pioneer in land management diversification. Through the extensive restoration of over 1000ha of degraded peatlands, a broad range of native woodland projects and better managing grazing densities and approaches, Lochrosque Estate is focussed on tackling climate change and eliminating the threat of biodiversity loss. The creation of 3,500 mini lochans is rewetting the peat and increasing its storage of carbon. By blocking ditches on the open hills it is slowing the flow from higher ground, reducing erosion, as well as reducing sediments and filtering the water, and reducing blockages to the water intakes on their hydroelectricity schemes.

By restoring the peatland the estate will avoid over 230,000 tonnes of carbon being emitted into the atmosphere over the next 100 years. Further phases of restoration are underway, and the residual benefits will continue to grow. By validating all the schemes through the Peatland Code with support from local businesses, the Estate now has a reliable stream of carbon finance through the sale of peatland carbon units. This income stream not only funds the ongoing maintenance and monitoring requirements but can also be deployed into the estate itself to further enhance its performance. Local, sustainable, green sector jobs have been created to carry out the works and will survive long into the future. (Scottish Landowners and Estates. 2021).

Santander and National Parks Revere project

Santander is part of the National Park and Palladium's (global impact firm) *Revere* project. This collaboration is supporting a programme of peatland restoration that will capture and lock in CO_2 and explore innovative solutions for attracting private capital to fund a nationwide portfolio of nature restoration projects. There is an aim to show that nature restoration and carbon capture projects can be self-funding and that there is potential to transform the scale and pace of this work.

Santander will fund a new project involving the restoration of 220ha of damaged peatland in the Cairngorms National Park. The site has the potential to avoid more than 16,000 tonnes of CO_2 emissions over its first 5 years and will help to establish and showcase Nature-based Solutions in the UK.

Each carbon credit will be assured by the UK government standard and independently validated by qualified auditors in accordance with the Peatland Code methodology. Santander's overall ambition is to support the transition to a low carbon economy. (National Parks UK. 2021)

Philiphaugh Estates, Dryhope, Scotland

Dryhope is a 77ha, 45 year restoration project on the Scottish border. The landowners were concerned about the condition of an actively eroding and drained blanket bog and

wanted to improve it alongside other environmental improvements on the farm. Forest Carbon worked alongside the Tweed Forum and NatureScot to develop the project that has involved blocking drainage ditches and reprofiling peat hags. The GHG emission savings were independently calculated and checked against the standards in the Peatland Code.

The NEX Group has a strong commitment to Corporate Social Responsibility and has also been an early buyer of Woodland Carbon Code units. The high standards of the Peatland Code and the commitment demonstrated by the landowner convinced the NEX Group to buy the carbon units from the project. The units were reported in the NEX Group annual report to demonstrate their commitment to an environmentally-sound approach to business (Forest Carbon. 2018).

Appendix 3 – Landowner cashflow modelling and market analysis

Landowner cashflow modelling (provided by Diane Smith, Defra Finance)

Methodology

Calculations are based on the UK Peatland Code Emissions Calculator (IUCN. 2020) for upland restoration and the published charge rates for Organic Farmers and Growers who is the accredited validator/verifier for the Peatland Code (OF & G 2021). The Emission Factors for lowland restoration is based on the BEIS managed Emissions Inventory (using cropland minus rewetted fen) (IPCC.2020). The model was based on a 100ha and 30 year agreement. The upland model was based on 90ha rewetting (£2,000/ha) and 10ha revegetation (£12,000/ha). The lowlands model was based on cropland restored to fen at £5,000/ha and 10,000/ha. A 5% discount rate is applied. Transaction costs of the Peatland Code were also considered. 'Selling early' as validated Pending Issuance Units (PIUs) is based on 70% PIUs at Year 0 and 30% as PIUs at Year 5. 'Selling later' is based on selling verified Peat Carbon Units (PCUs) evenly every 5 years from Year 5 to Year 30. The break-even price is the lowest price at which the investor achieves a positive Net Present Value on their investment.

Main findings

The costs of using the Peatland Code are affordable within the restoration costs of the modelled 100ha restoration. Affordability may be more of an issue for very small restorations.

Upland restoration

Upland restorations require significant public funding whether selling early as PIUs or selling later as PCUs.

Upland restorations based on PCU sales present significant cashflow challenges for 'cash poor' landowners. These challenges are considerably lessened (in terms of duration) for PIU sale.

The current approach of 75% public funding and a PIU price of about £11-12 should be sufficient to deliver simple upland restorations.

If there were to be a Peatland Carbon Guarantee based on PCUs, this would need to be set at c.£25/unit (alongside a 75% grant) to secure the confidence of a 'cash-poor' investor. A guarantee scheme for PIUs would be much less expensive and with much less long-term risk for the government – the purpose would be to simply give the 'cash-poor' landowner confidence to borrow for one year only.

Lowland restoration

Lowland restorations are much less likely to need public funding (although some degree of public funding is needed to achieve financial viability):

a. At £5,000/ha restoration cost, 50% government funding, a 5% discount rate, the PIU break-even price is £4.30. A PIU price of £9 would enable a restoration project to be viable with no government grant.
b. At £10,000/ha restoration cost, 50% government funding, 5% discount rate, the PIU break-even price is £8.60.

Public support for lowland restorations can therefore be focused on funding maintenance through ELMS (including paying compensation through ELMS for income forgone which tends to be a much larger opportunity cost for a landowner undertaking lowland restoration).

Lowland restorations present very significant cashflow challenges for 'cash-poor' landowners as the restorations are very expensive (c.£0.5m-c.£1.0m). A government loan facility to address cash flow issues may be needed, with a public grant required primarily to manage future maintenance and income forgone.

Costs over a longer period

By changing the agreement to 75 years (making it comparable to the market level analysis and closer to an average Peatland Code agreement period) the break-even PIU prices would be much lower:

- Upland scenario (75% public funding) = £4.50
- Lowland restoration at £5,000/ha (50% public funding) = £1.80
- Lowland restoration at £10,000/ha (50% public funding) = £3.50.

Number of units generated

Over 30 years, the upland model generates 8,560 units. The lowland model generates 67,840 units.

Over 75 years, the upland model generates 21,400 units. The lowland model generates 169,600 units.

Market analysis findings - Net Zero Strategy and CCC 6th report scenarios (provided by Dr Eva Scholz, NE Senior Specialist in Economics)

Methodology:

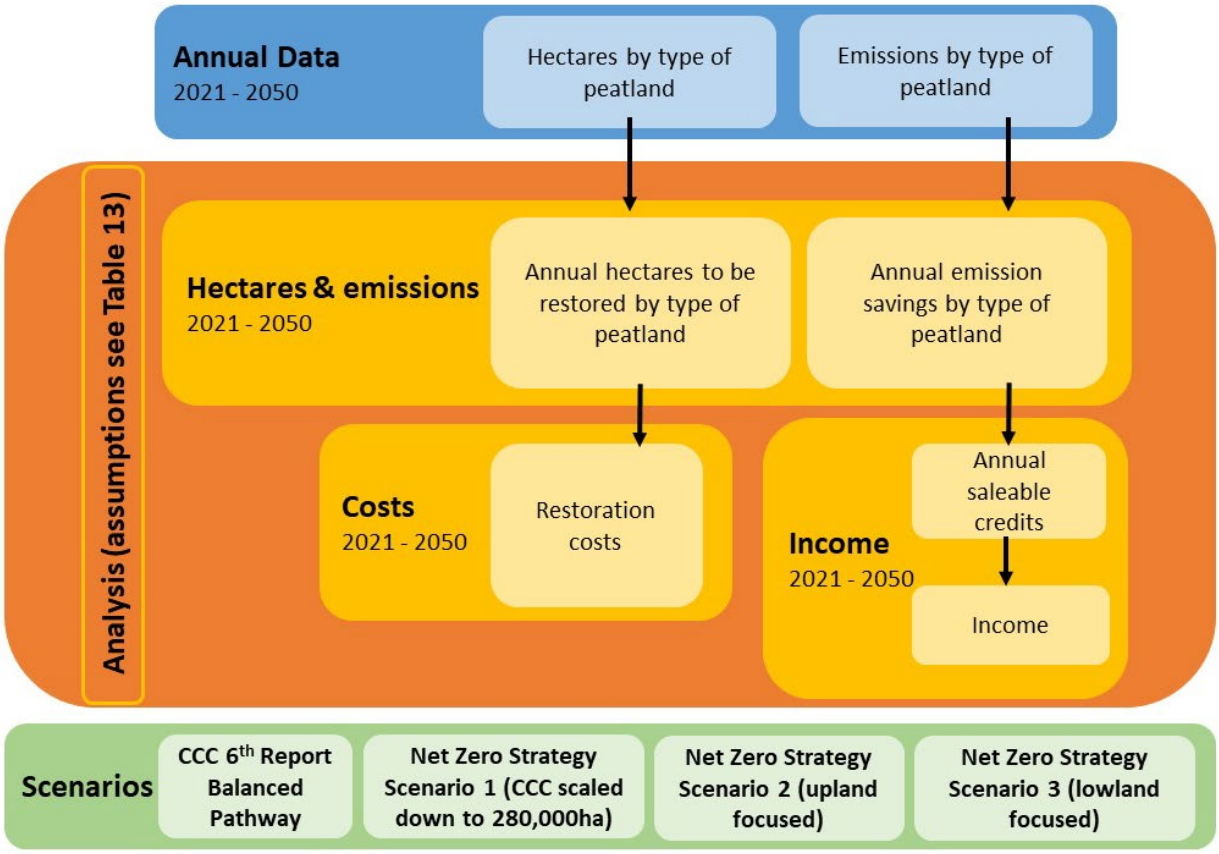

Figure 5. Market analysis model

The Net Zero Strategy (HMG. 2021b) contains a target of 280,000 ha of peatland restoration for England by 2050. The strategy is not prescriptive as to whether that will be achieved in either the uplands or lowlands, nor regarding the peatland category (bog, fen, peat extraction site, etc).

The CCC 6th Report (CCC. 2020a) Balanced Net Zero Pathway scenario is based on a larger 376,560 ha (rounded to 377,000 ha in this report's text) restoration target but does provide a methodological basis for modelling the market; it includes targets for upland and lowland restoration based on the actual areas and types of peatland categories and their associated emissions factors. The Net Zero Strategy does not include a useful breakdown of peatland types, so we have created the three Net Zero Strategy scenarios, by scaling down the CCC data (Table 5 & 6).

Table 5. Description of scenarios considered in the market analysis

Scenario name	Focus	Details
CCC 6th Report	Balanced Net Zero Pathway	Based on the CCC 6th Report Balanced Net Zero Pathway scenario (i.e. restoration of 100% of upland peatland and 75% of lowland peatland)
Net Zero Strategy scenario 1	Upland: lowland balance same as CCC target	This is the CCC 6th Report scenario scaled down by approximately 25%, equally across all peatland categories to achieve the 280,000 ha target.
Net Zero Strategy scenario 2	Upland focussed restoration	This scenario uses CCC 6th Report data and restoration targets for Upland rough grazing. As such 100% of upland peatland will be restored by 2045. The ambition for lowland grassland, paludiculture, cropland, Direct Water Level Management (DWLM) & Raised Water Level Continuously (RWLC) have been reduced relative to the CCC ambition to reach the 280,000 ha by 2050 target (see also * below).
Net Zero Strategy scenario 3	Lowland focussed restoration	This scenario uses the original CCC 6th Report data and restoration targets for the lowland area. To balance the figures, the ambition for upland rough grazing has been reduced relative to the CCC ambition to reach 280,000ha by the 2050 target (see also * below).

* In scenarios 2 and 3 the peatland categories: Forested peat/Forest removal (5,500ha) and Peat extraction Sites (7,200ha) remain the same as the CCC target as the areas involved are small and not considered to have a significant impact on the results. All peat types except Upland rough grazing are considered to be lowland.

Table 6. Details on scenarios used in the analysis and comparison to CCC 6th report figures

Type of peatland	CCC 6th Report Scenario		Net Zero Strategy Scenario 1		Net Zero Strategy Scenario 2		Net Zero Strategy Scenario 3	
	%		Area ('000 ha)	%	Area ('000 ha)	%	Area ('000 ha)	%
Upland rough grazing	54.5		152,730	54.5	205,400	73.4	108,840	38.9
Forest removal	1.5		4,110	1.5	5,530	2.0	5,530	2
Peat extraction site	1.9		5,360	1.9	7,210	2.6	7,210	2.6

Lowland grassland	8.2	22,890	8.2	12,020	4.3	30,790	11
Paludiculture	7.0	19,550	7.0	10,270	3.7	26,290	9.4
Full cropland restoration	11.6	32,590	11.6	17,110	6.1	43,820	15.7
Sustainable cropland – DWLM	8.7	24,440	8.7	12,840	4.6	32,870	11.7
Sustainable cropland - RWLC	6.5	18.33	6.5	9,630	3.4	24,650	8.8
Totals	376,560ha	280,000ha	100%	280,000ha	100%	280,000ha	100%

Table 7. Estimated emissions and saleable credits from different peatland types

Type of peatland	CCC 6th Report Scenario		Net Zero Strategy Scenario 1		Net Zero Strategy Scenario 2		Net Zero Strategy Scenario 3	
	Total emission savings (ktCO2e)	Total saleable credits 000s	Total emission savings (ktCO2e)	Total saleable credits 000s	Total emission savings (ktCO2e)	Total saleable credits 000s	Total emission savings (ktCO2e)	Total saleable credits 000s
Upland rough grazing	278	213	207	158	278	213	147	112
Peat extraction site	47	36	35	27	47	36	47	36
Lowland grassland	654	500	486	372	255	195	654	500
Forested peat	47	36	35	27	47	36	47	36
Cropland	3687	2821	2742	2098	1440	1102	3687	2821
Totals	**4713**	**3606**	**3505**	**2682**	**2067**	**1582**	**4582**	**3505**

Table 8. Present value of income (£)

Type of peatland	CCC 6th Report Scenario	Net Zero Strategy Scenario 1	Net Zero Strategy Scenario 2	Net Zero Strategy Scenario 3
Upland grassland	£95,120,000	£70,730,000	£95,120,000	£50,400,000
Peat extraction sites	£19,650,000	£14,610,000	£19,650,000	£19,650,000
Lowland grassland	£200,950,000	£149,420,000	£78,470,000	£200,950,000
Forested peat	£14,360,000	£10,680,000	£14,360,000	£14,360,000
Cropland	£1,132,540,000	£842,130,000	£442,270,000	£1,132,540,000
Total	£1,462,620,000	£1,087,570,000	£649,870,000	£1,417,900,000

Table 9. CCC 6th report scenario: detailed breakdown of present value (PV) of income, restoration costs and funding gap

Type of peatland	Restoration costs (PV)	Peatland Carbon Income (PV)	Restoration Funding gap (PV)
Upland grassland	£366,100,000	£95,120,000	£270,980,000
Peat extraction sites	£51,500,000	£19,650,000	£31,850,000
Lowland grassland	£162,400,000	£200,950,000	-£38,550,000
Forested peat	£29,100,000	£14,360,000	£14,740,000
Cropland	£673,100,000	£1,132,540,000	-£459,440,000
Totals	£1,282,200,000	£1,462,620,000	-£180,420,000

Table 10. Net Zero Strategy scenario 1: detailed breakdown of present value (PV) of income, restoration costs and funding gap

Type of peatland	Restoration costs (PV)	Peatland Carbon Income (PV)	Restoration Funding gap (PV)
Upland grassland	£272,200,000	£70,730,000	£201,470,000

Peat extraction sites	£38,300,000	£14,610,000	£23,690,000
Lowland grassland	£120,700,000	£149,420,000	-£28,720,000
Forested peat	£21,700,000	£10,680,000	£11,020,000
Cropland	£500,500,00	£842,130,000	-£341,630,000
Totals	£953,400,000	£1,087,570,000	-£134,170,000

Table 11. Net Zero Strategy scenario 2: detailed breakdown of present value (PV) of income, restoration costs and funding gap

Type of peatland	Restoration costs (PV)	Peatland Carbon Income (PV)	Restoration Funding gap (PV)
Upland grassland	£366,100,000	£95,120,000	£270,980,000
Peat extraction sites	£51,500,000	£19,650,000	£31,850,000
Lowland grassland	£63,400,000	£78,470,000	-£15,070,000
Forested peat	£29,100,000	£14,360,000	£14,740,000
Cropland	£262,800,000	£442,270,000	-£179,470,000
Totals	£772,900,000	£649,870,000	£123,030,000

Table 12. Net Zero Strategy scenario 3: detailed breakdown of present value (PV) of income, restoration costs and funding gap

Type of peatland	Restoration costs (PV)	Peatland Carbon Income (PV)	Restoration Funding gap (PV)
Upland grassland	£194,000,000	£50,400,000	£143,600,000
Peat extraction sites	£51,500,000	£19,650,000	£31,850,000
Lowland grassland	£162,400,000	£200,950,000	-£38,550,000

Forested peat	£29,100,000	£14,360,000	£14,740,000
Cropland	£673,100,000	£1,132,540,000	-£459,440,000
Totals	£1,110,100,000	£1,417,900,000	-£307,800,000

Given the state of the emerging peatland carbon market and the scale and duration of peatland restoration, assumptions have been made. Upland restoration costs are based on experience of numerous restoration projects. Lowland restoration costs will be more variable; experience gained from the PGS and NEIRF projects will help refine the models. The table contains assumptions that will have either a conservative, optimistic, or neutral effect on costs or income. These assumptions are summarised in Table 13 below.

Table 13. Assumptions for the market level model

Assumption	Unit	Comments
Length of management agreement (payback period for PCUs)	75 years	Peatland Code agreements can be 30-100 years
Costs of restoration (per ha)	n/a	n/a
Rewetting upland bog	£2000	Typical upland cost
Revegetating upland bog	£12000	Typical upland cost
Upland rough grazing	£3100	Estimate for upland rewetting and revegetation. Includes £100 for costs for Peatland Code, etc.
Forest removal	£10100	Average restoration cost used. Only a small area affected.
Peat extraction site	£10100	Average restoration cost used. Only a small area affected.
Lowland grassland	£10100	Lowland restoration costs can vary. Conservative estimate, based on Defra/Natural England opinion.
Paludiculture	£10100	As above.
Full cropland restoration	£10100	As above.

Sustainable cropland – Direct water level management (DWLM)	£10100	As above.
Sustainable cropland – Raised water level continuously (RWLC)	£10100	As above.
Rewetting upland bog	£2000	Based on real costs.
Revegetating upland bog	£12000	Based on real costs.
Discount rate	5%	Unless otherwise stated
Scientific uncertainty buffer (10%) and Risk Buffer reductions (15%) applied	Multiplier of 0.765	Applied to the number of carbon units to manage uncertainty. Conservative impact on the number of units available.
All units sold as PIUs, not PCUs.	Not applicable	This is based on experience from the Peatland Code and for analytical convenience. The impact is ambiguous. Everything else being equal, this has a favourable impact on income. PCUs may however attract higher carbon prices, leaving the overall impact ambiguous.
All GHG emissions reductions happen at the time of restoration.	Not applicable	Based on the CCC approach. Unrealistic as GHG reductions occur as the restoration proceeds. As with the above assumption this would be very complex to model otherwise. Will have an optimistic impact on the timing of availability of units.
There is no substantial change in the regulatory environment.	Not applicable	Assumes peatland restoration is not made mandatory.

Appendix 4 - Companies affected by the Companies (Strategic Report) (Climate related Financial Disclosures) Regulations 2021

This regulation (Legislation.gov.uk. 2021a) comes into force in April 2022 and effects the following:

1. UK companies that have more than 500 employees and either have securities admitted to trading on a UK regulated market or undertake banking or insurance activities (distinguished from UK Premium and Standard Listed Companies below)
2. UK Premium and Standard Listed Companies with over 500 employees

1 and 2 include: Traded companies; Banking companies; Authorised insurance companies; and Companies carrying on insurance market activity.

3. UK registered companies with securities admitted to Alternative Investment Market (AIM) with over 500 employees
4. Limited Liability Partnerships (LLP) covered by the “500 test” (500 test = 500+ employees and turnover >£500m.)
5. UK registered companies which are not included in the categories above and are covered by the “500 test”

List of abbreviations

Shortened	Full wording	Definition
BAU	Business As Usual	Ordinary operations of a company or organisation.
BEIS	Department for Business, Energy and Industrial Strategy	A ministerial department.
BNG	Biodiversity Net Gain	Delivers measurable biodiversity improvements by creating or enhancing habitats affected by development.
CCC	Climate Change Committee	Independent, statutory body established under the Climate Change Act 2008 that advises government.
CO_2	Carbon dioxide	A GHG - mainly emitted from burning fossil fuels, industrial processes, land use change and oxidation of peat.
CO_2-eq	Carbon dioxide equivalents	A metric measurement used to compare the emissions from various GHGs based on their global warming potential.
CH_4	Methane	A GHG - from fossil fuels that is also emitted from agricultural landfilled waste and land use change.
CSR	Corporate Social Responsibility	Can take many forms but it is a self-regulating business model that helps a company be socially accountable to itself; its stakeholders and the public.
EF	Emissions Factor	Quantity of GHG emitted from a hectare of peat soil per year.
ELMS	Environmental Land Management Scheme	Government led incentive scheme that pays land managers to provide agreed environmental outcomes.
EPAP	England Peat Action Plan	Government document that sets the long-term vision for the management, protection and restoration of peatlands, so that they provide a wide range of benefits for nature and the climate.
ERG	Environmental Reporting Guidelines	Guidance to help companies comply with the Streamlined Energy and Carbon Reporting regulations, including GHG reporting.
FNC	Financing Nature Coalition	Collaboration of organisations providing advice to government on the scaling-up of environmental markets scaling-up of environmental markets
FRM	Flood Risk Management	Strategic plans for areas at risk of surface, river and sea flooding and have actions that help to contribute to creating a better place for people and wildlife.
GHG	Greenhouse Gases	GHG includes carbon dioxide (CO^2), methane (CH_4) and nitrous oxide (N_2O).
ha	Hectare	100 metres x 100 metres or 10,000m^2
IUCN	International Union for the Conservation of Nature	Global membership union of both governmental and civic society organisations that aims to conserve nature and accelerate the transition to sustainable development. The IUCN's UK Peatland Programme and project exists to promote peatland restoration in the UK.

LULUCF	Land Use, Land Use Change and Forestry	A land use topic or sector or workstream under the United Nations Climate Change Secretariat.
NEIRF	Natural Environment Investment Fund	Government fund to support the emerging green finance market.
N_2O	Nitrous oxide	A GHG - mainly emitted from fertiliser used in agriculture, burning fossil fuels and industrial processes.
NLHF	National Lottery Heritage Fund	UK funding body that uses money from the national lottery to fund heritage projects that connect people and communities.
NRN	Nature Recovery Network	A network that connects wild places and gives nature room for nature to thrive, on land and at sea and to adapt to change within England.
PCU	Peatland Carbon Unit	PCU is a verified carbon unit and is equal to tonne of CO_2-eq. Verified carbon is the actual reduction in carbon emission at various points during the lifetime of a Peatland Carbon Code scheme.
PGS	Peat Grant Scheme	A competitive grant scheme (Nature for Climate Peat Grant Scheme) that provides funding to incentivise peatland restoration in England.
PIU	Pending Issuance Unit	A Pending Issuance Unit (PIU) is effectively a 'promise to deliver' a carbon unit in future, based on predicted reduction in emissions. It is not 'guaranteed' and cannot be used to report against UK-based emissions until verified and converted to a PCU.
SBTi	Science Based Targets Initiative	More information is provided in Section 3.3.
TCFD	Taskforce on Climate-related Financial Disclosure	More information is provided in Section 3.3.
TSVCM	Task Force on Scaling Voluntary Carbon Markets	More information is provided in Section 3.3.
UNFCCC	United Nations Framework Convention on Climate Change	The UNFCCC secretariat is tasked with supporting the global response to the threat of climate change.
VCMI	Voluntary Carbon Markets Integrity Initiative	More information is provided in Section 3.3.
WACC	Weighted average cost of capital	All sources of capital, including common stock, preferred stock, bonds, and any other long-term debt, are included and proportionately weighted. It is one way to arrive at the required rate of return that investors demand from a particular company.
WCU	Woodland Carbon Unit	WCU is a tonne of CO_2-eq which has been sequestered in a Woodland Carbon Code verified woodland.
WWF	World Wide Fund for Nature	Nature conservation charity.

Glossary

Term	Definition
Abatement	In this report the term abatement is used to mean a reduction in carbon emissions from a site brought about through peatland restoration.
Bundling	Refers to the selling of peatland carbon units combined with other environmental benefits e.g. biodiversity. These benefits are sold together to one buyer.
Carbon unit	One tonne of carbon dioxide or the equivalent amount of greenhouse gases.
Carbon credit	A carbon credit represents either the permanent removal of a tonne of CO2e from the atmosphere, or the avoidance of one tonne of CO2e being emitted in the first place, through changes in land use or energy generation.
Charismatic carbon	Used to describe peatland where carbon units are the primary benefit alongside biodiversity, landscape, social and water quality benefits.
Deep peat	According to NE reports and 6th CCC report it is peat that is at least 40cm or deeper. The Peatland Code requires at least 75% of the project area to have peat that has a depth of 50cm or more.
Emissions Inventory	The *Devolved Administration GHG Inventory* sits within the National Atmospheric Emissions Inventory.
Net Zero	Net zero means that total greenhouse gas (GHG) emissions would be equal to or less than the emissions removed from the environment.
Offsets	A carbon offset broadly refers to a reduction in GHG emissions – or an increase in carbon storage (e.g. through land restoration or the planting of trees) – that is used to compensate for emissions that occur elsewhere.
Sequestration	Carbon sequestration is the process of removing carbon from the atmosphere and depositing it in a reservoir such as peat or timber.
Stacking	Refers to the selling of peatland carbon units independently of and alongside other environmental benefits e.g. biodiversity. These benefits may be sold separately to possibly different buyers.

Wasted peat	Wasted peat is organic soil, less than 40 cm in depth due to intensive use (mainly for crop production). Due to insufficient data however, wasted peat is assumed to emit the same level of emissions as deep peat.

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