England's peatlands: carbon storage and greenhouse gases

Estimated carbon storage in England's peatlands

Information on area and status of peatlands can be combined with estimates of peat carbon content, density and depth to estimate the total carbon stored in our peatlands. The areas mapped above as peatlands will in reality support a mixture of deeper and shallower peats as well as areas of mineral soil. Peat depth is also extremely variable, with some large peatland areas being relatively shallow and other peatlands, particularly in basins, containing depths of 8m or more. However, many estimates of peat carbon[6, 7, 8] have assumed only 1m depth in England and Wales, and deeper peat depths in Scotland, which may have resulted in the importance of English and Welsh peats in overall UK soil carbon* being under-estimated.

Natural England has gathered information on peat depth, average carbon content and density from a range of sources including academic and soil survey publications and our own survey data [9, 10, 11, 12, 13, 14]. This data is, inevitably, not comprehensive but is, we believe, the best information currently available. The fact that some of this data is over 25 years old confirms the clear need to continue to update our information on peat depth and density**, ideally with a more comprehensive national survey.

We have used this data to estimate the total amount of carbon stored within deep and shallow peaty soils in England. These are presented in Table 3 and are depicted in Map 8.

If all 584 million tonnes of carbon stored in English peatlands were lost to the atmosphere, this would be equivalent to 2.14 billion tonnes of CO_2, which is around five years of England's annual CO_2 emissions*** [15].

Table 3: Estimated total carbon stored in England's deep and shallow peaty soils (tonnes C).

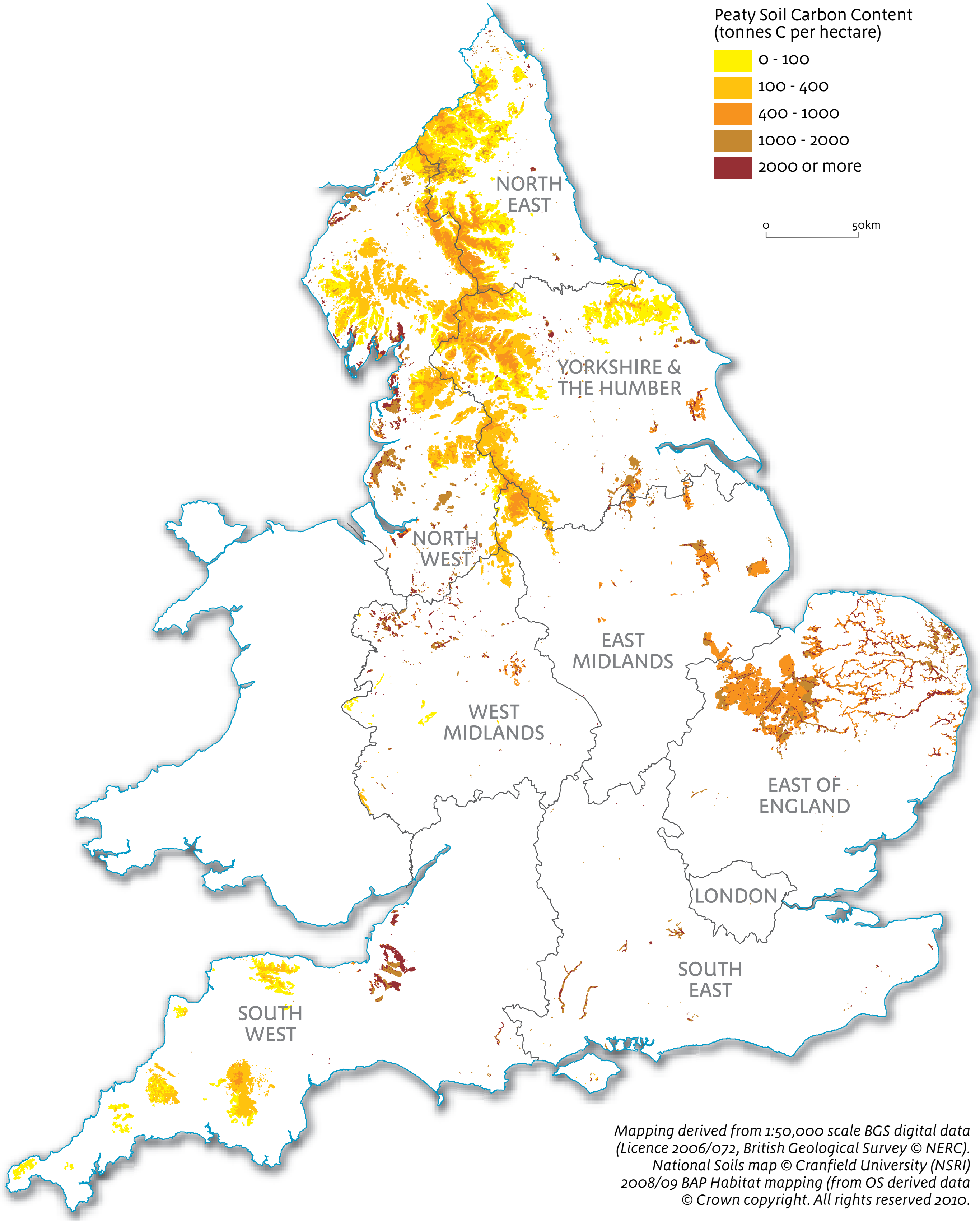
Peatland Type	Megatonnes Carbon	% of total peatland carbon
Blanket bog and Upland Valley Mire	138.0	24%
Raised bog	57.5	10%
Lowland Fen (deep)	144.0	25%
Lowland Fen (wasted)	186.4	32%
Shallow Peaty Soils	58.5	10%
All Deep and Shallow Peaty Soils	**584.4**	

* For example Howard et al (1995) claim that 75% of all British soil carbon is in Scottish peats.

** At typical rates of peat wastage ~30cm of peat is likely to have been lost from cultivated peatlands since this data was collected, potentially releasing ~210 million tonnes of greenhouse CO_2 into the atmosphere.

***427 $MtCO_2$ data from 2007. (http://www.naei.org.uk/reports.php)

Map 8: Limited peat depth information suggest that while our upland peatlands cover a larger area, our lowland peatlands remain highly important for carbon storage, even in areas of wasted peatland. Much of this may already be lost through cultivation and wastage.



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Peatlands and greenhouse gases

Peatlands both emit and capture CO_2 and the balance of these processes depends on peatland condition. They may also be sources or sinks of methane and sources of nitrous oxide, both of which are more powerful greenhouse gases than CO_2. The impact of peatlands on global warming is the result of the combined effects of all these greenhouse gases, which in turn depends on their global warming potential (see opposite)[16].

Greenhouse gases in waterlogged peatlands
An active waterlogged peatland has a surface layer of living plants, which absorb CO_2 from the atmosphere. Some plant material is deposited as litter on the peat surface and some of this passes to the lower, anaerobic, layers of the peat, where it can continually build up. Some decomposes to release CO_2, especially when water tables fall in the summer, but a proportion of the carbon within the plant material enters longer term storage in the peat. An intact vegetation surface means that there is little peat carbon lost through erosion, and since rainwater flows mainly across the surface layers, little peat carbon is lost by being dissolved in water.

Deeper in the peat there is little oxygen available and decomposition is carried out slowly by a group of microorganisms called methanogens. These organisms get their energy by breaking up larger organic molecules into methane. This can reach the atmosphere by diffusing through the peat water, forming bubbles of "marsh gas" or by being transported through the hollow tissues of peatland "shunt" plants, which can actively pump methane out through their leaves[17]. Some of the methane reaching the surface layer of peatlands is then broken down to form CO_2 by another group of microorganisms – the methanotrophs.

Nitrous oxide (N_2O) is produced when nitrate in the soil is broken down in low-oxygen conditions by bacteria. In waterlogged peatlands oxygen is limited and the mineral nitrogen present is ammonium rather than nitrate, so N_2O emissions are limited.

Global Warming Potential

Different greenhouse gases have different abilities to retain heat; they also persist for different times in the atmosphere before breaking down and becoming inactive. It is possible to compare the impact of different gases on global warming over a given timescale by calculating how much CO_2 would generate the same warming effect. This measurement, called Global Warming Potential, is expressed as Carbon Dioxide Equivalents (CO_2-e). Over a 100 year timescale, methane is 25 times more powerful at warming the planet than CO_2, so 1 tonne of methane emitted can be expressed as 25 tonnes CO_2-e. Nitrous oxide has an even greater warming effect over a 100 year timescale and a tonne of this gas could be expressed as 298 tonnes CO_2-e (IPCC, 2007).

Greenhouse gases in damaged and drained peatlands
When peatlands become degraded, drainage has the largest single impact on the flow of greenhouse gases. As drainage lowers the peat water table, air penetrates deeper into the peat and this enables the previously stored carbon to be decomposed into CO_2.

Cultivation of the drained peat layer introduces yet more air and increases the rate of decomposition. The drains that cut through the peatland draw water from deeper in the peat, and this carries away more dissolved carbon to streams and rivers, giving many of our peatland streams their brown colouration. Drained upland peats, and those with heather-dominated vegetation, are also more prone to develop peat pipes: networks of water channels that run through the peat mass, eroding it from the inside. Bare peat associated with drains, fires, cultivation or other disturbance loses solid particles of peat, which are washed from the peat surface by rain and running water or dislodged by frost heave and wind. These find their way into watercourses, where they are transported downstream. It is

Peatland restoration, such as gully blocking, raises the water table, reducing CO_2 losses, but increasing methane emissions. Overall, peatland restoration is beneficial from a global warming perspective.

believed that a significant proportion[18, 19] of dissolved carbon is again released as CO_2 from the oxygen rich waters of the stream, although more research is required to determine the fate of peat carbon lost through erosion or in solution.

While methane is still produced in the deeper wetter peat, the drainage means there is a greater volume of more oxygen-rich peat where methanotrophs can process this methane back into CO_2. Methane processing here can be so active that it also absorbs methane from the atmosphere, making most drained peatlands likely net methane sinks.

Peatlands drained for forestry lose carbon from their peat as CO_2, but this is offset by the CO_2 captured by the growing trees, and by accumulation of forest litter. This makes most afforested peatlands net sinks for greenhouse gases during their early rapid growth stages. As trees reach maturity, the amount of carbon they capture reduces, and the CO_2 lost from the peat turns them back into net sources of greenhouse gases. However, most forests are felled and replanted every 60-70 years, which maintains them as active sinks for carbon. The long-term value of the wood produced as a carbon sink depends on how rapidly the wood products are converted back into CO_2: rapidly as fuel or paper, or over centuries in the case of structural timbers.

More frequent wetting and drying of peatlands provide the conditions for nitrous oxide to be released, and while upland peatlands receive some nitrate from atmospheric deposition, the application of fertiliser nitrogen to drained agricultural peatlands is responsible for the vast majority of peatland nitrous oxide emissions.

Greenhouse gas emissions from restored peatlands

Peat restoration involves raising the water table nearer to the surface and re-establishing peat forming fen or bog vegetation. A recent Defra-funded project has reviewed the impact of peatland restoration on greenhouse gas fluxes from peatlands[20]. When a drained peatland is re-wetted CO_2 emissions from decomposition of the peat are usually significantly reduced due to the return to anaerobic conditions. Restoration should also eventually result in a return to active peat formation, and ongoing sequestration of atmospheric carbon. Revegetation of the peat should mean that surface erosion losses of peat material should also be significantly reduced, although peat pipes may continue to erode the peat mass under the surface, and the long term impact on loss of dissolved peat carbon remains unclear, with research providing conflicting messages[21, 22].

Rewetting a peatland is likely to result in increased emissions of methane compared to the pre-restoration, drained state. It is important to understand the scale and nature of methane emissions following re-wetting, since these increases could counteract the prevented losses of CO_2. Very high methane emissions are associated with peatlands where a large amount of standing vegetation becomes flooded, but removing plant residues and careful water table control should help to prevent this[23]. There is potential to reduce methane emissions on re-wetting by controlling the abundance of plants that act as methane shunts, and re-establishing a surface layer of hummocky bog mosses where methane may be broken down[24]. Lowland peats rich in sulphate, including many of those found in the East Anglian Fens, may have lower methane emissions than expected because methanogens here give way to sulphate-reducing bacteria[25].

The impact of re-wetting peatland on the nitrous oxide emissions seems to depend strongly on type of peatland and its previous management. Restoration generally reduces the minimal nitrous oxide emissions from drained low nutrient raised and blanket bogs[26]. The picture is less clear with the re-wetting of drained and fertlised agricultural peatlands, where some studies show reductions but others have observed increased N_2O emissions[27].

Restoration of afforested peatlands may be seen as resulting in an immediate loss of the carbon stored in the trees. However, where afforestation was for commercial forestry purposes these trees would have been felled at some point anyway, and rates of carbon emissions from the wood products will depend on their subsequent use. Following felling the restored bog vegetation would sequester carbon more slowly than the trees, meaning that initially, the restoration would be unlikely to deliver overall greenhouse gas benefits. However, the loss of carbon from the peat would be slowed, and, if successful, restoration would deliver new long-term carbon sequestration. After ~150 years or more peatland restoration would probably begin to deliver more greenhouse gas benefits than afforestation. This calculation is based on only consideration of gaseous emissions, and conservatively only considers CO_2 emissions from afforested peatlands*. Including methane emissions from afforested peat, and emissions from dissolved and particulate carbon being lost from afforested peatlands would be likely to result in earlier emissions benefits being realised.

In summary, peat restoration generally decreases emissions of CO_2, may increase or decrease nitrous oxide emissions, and generally increases methane emissions. In some cases, restoration may result in overall increases of greenhouse gas emissions. However, these higher emissions are usually seen as a temporary phase which is followed by greenhouse gas flux more akin to that of an undamaged peatland[28].

A number of recent literature reviews[20, 29, 30], have all concluded that restored peatlands generally have less of an impact on global warming than degraded peatlands. Thus, restoration is generally beneficial from a global warming point of view. However, there is a clear requirement for more research into greenhouse gas and carbon flux from peatlands under existing and restoration management. There is more evidence for the impact of restoration on raised bogs than there is for fens, and there are very few studies which indicate the greenhouse gas and carbon impacts of restoring blanket bog.

* In this calculation it has been assumed that afforested peatlands have: 2.49 tCO_2-e ha^{-1} yr^{-1} lost from peat, 2.30 mean tCO_2-e ha^{-1} yr^{-1} captured in forest litter until equilibrium is reached after 150 years and 8.52 mean tCO_2 ha^{-1} yr^{-1} captured by trees with a 70 year felling rotation. Restored peatlands are assumed to have 10 years of restoration peat emissions at 2.78 tCO_2-e ha^{-1} yr^{-1} followed by undamaged emissions of -4.11 tCO_2-e ha^{-1} yr^{-1}, and building up a 7 cm mat of bog mosses capturing 41 tCO_2 ha^{-1} after 10 years.

Accounting for GHG emissions from peatlands

Emissions factors for peatlands

Greenhouse gas emissions from the direct management of peatlands can and should be included in a country's record of its emissions. All countries that have signed the United Nations Framework Convention on Climate Change (UNFCCC) are required to prepare annual Greenhouse Gas Inventories recording their annual greenhouse gas emissions from all human-induced sources.

All GHG inventories should be prepared to a standard format, using internationally agreed approaches to accounting for emissions. Guidance on how to prepare inventories[32] is given by the Intergovernmental Panel on Climate Change (IPCC)[33] – an independent body made up of the world's leading scientists and experts who report directly to the UNFCCC.

The IPCC provides a range of broad 'emission factors' that can be used to estimate emissions from different activities[34]. As the IPCC's guidance is for all countries, the emission factors they provide (called 'Tier I') must be generalisations applying to broad climate zones (i.e. temperate, boreal, and tropical). The IPCC recommends that countries should develop more detailed 'Tier II' emission factors or 'Tier III' modelling approaches that are relevant to their national circumstances. This is particularly the case with emission factors from land use and agriculture as there can be significant variations between, and even within, countries due to differences in climate, soil types, geography and other factors.

The IPCC guidance explicitly states that national inventories should account for emissions from peatlands that are managed for forestry, grazing, cultivation, extraction or development. A series of Tier I emission factors are provided for some of the greenhouse gases arising from these different activities in temperate peatlands.

Peatlands in the Kyoto Protocol

The national greenhouse gas inventories are used to monitor compliance for those countries who signed up to the Kyoto Protocol[35] and have legally binding commitments to reduce GHG emissions over the period 2008–2012.

Under Kyoto, countries can chose to include emission reductions delivered from a range of land management activities such as the improved management of existing forests, increasing soil carbon sequestration and the restoration of degraded land.

Peatland restoration is not explicitly included in the list of optional activities*, although there was agreement in principle at Copenhagen to allow countries to voluntarily include 'wetland re-wetting' as an option in any post-2012 international protocol.

Therefore, at present any emission savings delivered by peatland restoration do not count towards meeting the Kyoto commitment.

Estimated peatland emissions and potential greenhouse benefits from restoration

Natural England's estimate of GHG emissions from England's peatlands

We have collated IPCC peatland emission factors, factors derived from studies of European peatlands[26, 23] and from the Durham Carbon Model, as informed by initial results from monitoring work at Bleaklow Hill and Cronkley Fell**. These have been used to provide estimates of GHG emissions from English peatlands, including those that have been restored, under a range of managements. Where more than one land use or management is applied, we have assumed that emissions are additive, except where restoration has occurred, when typical restoration emissions have been assumed.

This represents our estimate of greenhouse gas emissions from peatlands in England but more

* Under Article 3.4 of the Protocol.

** Durham Carbon Model, from Worral (2010), pers comm.

Table 4: Emissions factors used by Natural England to estimate greenhouse gas flux from England's peatlands under a range of managements. Units are tonnes CO_2-e ha^{-1} yr^{-1}. No factors were available for peatlands supporting woodland, scrub, semi-natural vegetation, purple moor-grass or with old peat cuttings.

	Blanket Bog/ Raised Bog	Fen Peatlands (deep)	Fen Peatlands (wasted)	Shallow Peaty Soils
Cultivated & temporary grass	22.42c	26.17e	4.85g	18.32a
Improved grassland	8.68d	20.58f		0.92a
Extracted	4.87a	1.57a		
Rotationally burnt	2.56b			
Afforested	2.49a	2.49a		2.49a
Restored	2.78d	4.2c		
Bare peat	0.06b			
Gripped	-0.2b			0.73a
Hagged and Gullied	-0.2b			
Overgrazed	0.1b			
Undamaged	-4.11b	4.2c		

a IPCC tier 1 emissions factor [32]

b Based on simplified version of Durham Carbon Model (Worrall, 2010) [36]

c Based on data from Couwenberg et al (2008) [23]

d Emissions factors from Byrne et al (2004) [37]

e CO_2 and CH_4 factors from Couwenberg et al (2008), N_2O from IPCC tier 1

f CO_2 and CH_4 factors from Couwenberg et al (2008), N_2O from Byrne et al. (2004)

g CO_2 from Bradley (1997) [38], N_2O from IPCC tier 1

data are required to develop a more accurate picture of emissions. A summary of the emissions factors we have used is shown in Table 4.

Our estimate is that emissions from degraded peatlands in England are **2.98 Mt CO_2-e a year.** We fully recognise that the emission factors used in this estimate require refinement and improvement, so that they reflect UK conditions. We also acknowledge that our emission factors are generally not the same as those used by the UK's greenhouse gas inventory. On that basis, our estimate should not be compared to emissions data provided by the inventory.

The relevant section of the UK GHG Inventory could, however, be updated to incorporate our improved area data and to provide a more complete picture of current emissions from degraded peatlands.

Table 5 summarises our estimate of total greenhouse gas emissions from English peatlands under a range of different uses and conditions.

If our estimate is correct, then annual emissions of 2.98 Mt CO_2-e would mean that England's peatlands are an important element in the UK's mitigation efforts. Although 2.98 Mt CO_2-e is less than 1 % of total UK GHG emissions it is roughly the same as CO_2 emissions from around 370,000 houses and similar to emissions from the UK chemical industry (3.25 Mt CO_2-e).

Potential scale of greenhouse gas benefits from restoration

Our analysis suggests that England's peatlands are a relatively significant source of emissions. In order to make the case for the inclusion of peatland restoration as a recognised climate

Map 9: The majority of England's peatlands are currently sources of greenhouse gases, with notable 'hotspots' in the lowlands. Some upland peat areas are still capturing carbon, but most are also sources.

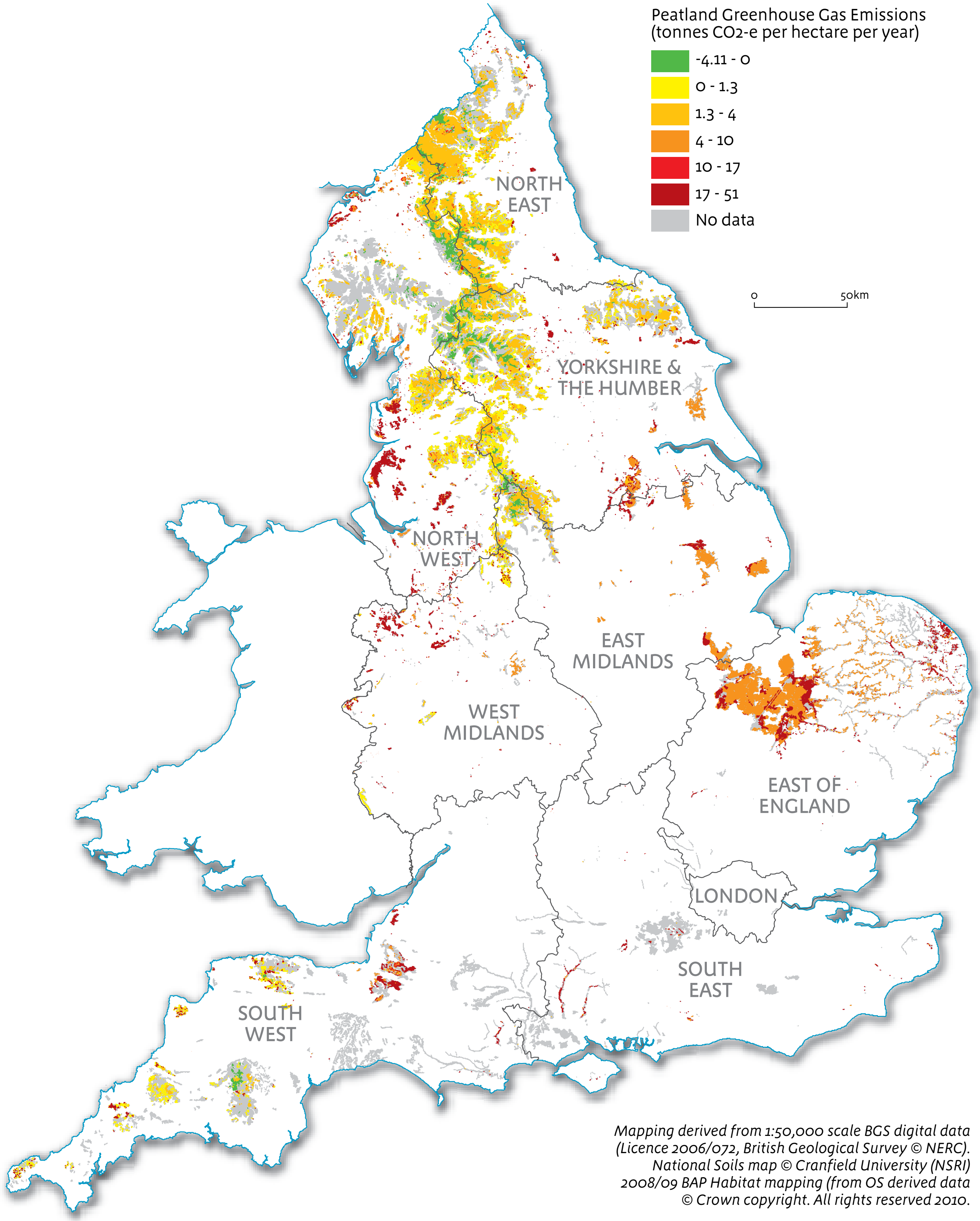

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Table 5: Total estimated greenhouse gas emissions from peatlands under a range of uses, land covers and peat condition. Units are millions of tonnes (Mt) CO_2-e per year.

	Blanket Bog	Raised Bog	Fen Peatlands (deep)	Fen Peatlands (wasted)	Shallow Peaty Soils	Total
Cultivated & temporary grass	0.01	0.20	0.96	0.55	0.12	1.83
Improved grassland	0.05	0.04	0.42	-	0.10	0.61
Rotationally burnt	0.26	0.00	-	-	-	0.26
Afforested*	0.06	0.01	0.00	-	0.16	0.24
Restored	0.01	0.00	0.02	-	-	0.03
Extracted**	0.00	0.02	0.00	-	-	0.02
Overgrazed	0.00	0.00	-	-	-	0.00
Bare	0.00	0.00	-	-	-	0.00
Gripped***	-0.01	-0.00	-	-	0.01	-0.00
Eroded***	-0.01	-0.00	-	-	-	-0.01
Undamaged	-0.02	-0.00	0.00	-	-	-0.02
Total estimated GHG flux megatonnes CO_2-e yr^{-1}	**0.35**	**0.28**	**1.40**	**0.55**	**0.40**	**2.98**

Table 6: Estimated emissions reductions if all degraded peatland were restored. This assumes a 40 year time frame where restoration emission rates occur for 10 years followed by 30 years of emissions typical of undamaged peatlands. Not all peatland managements, land covers and conditions have been included, and this represents only peatlands for which data were available.

Deep Peat Type	Estimated emissions reductions following restoration of peatlands in England (Mt CO_2-e yr^{-1})
Blanket Bog Peatlands	0.86
Raised Bog Peatlands	0.33
Lowland Fen Peatlands (deep)	1.14
Lowland Fen Peatlands (wasted)	0.07
Total	**2.40**

* These emissions, and subsequent calculations, only show those from the peat itself, and do not account for carbon sequestered in forest vegetation.

** These are the emissions from peatlands affected by the extraction process itself and do not include subsequent emissions from the horticultural use of peat when it is applied in gardens as a growing medium.

*** Limited data from England has suggested that these drained peatlands may remain a modest carbon sink, but studies of European drained peatlands[37] have indicated higher loss rates, which have been used to estimate peat carbon loss in Scotland and Wales[42]. Applying these rates to England's drained upland peat would suggest an additional 0.54 million tonnes CO_2-e is emitted annually, a total of 3.52 million tonnes CO_2-e. Restoration of these areas would deliver emissions savings of 0.81 million tonnes CO_2-e per year.

Agri-environment payments have enabled raised water levels on this former arable land under near Methwold, Norfolk. Re-wetting cultivated peatlands could help reduce our greenhouse gas emissions by up to 1.2 million tonnes of carbon dioxide equivalent each year

change mitigation measure, we need to know the potential scale of greenhouse gas benefits that could be realistically achieved.

Estimated current emissions rates from peatlands under a range of managements and land covers were compared with emissions rates that could be delivered by peatland restoration over a 40 year period. Post restoration emissions were assumed to have a composite rate of 10 years of emissions reflecting restoration and 30 years of emissions reflecting an undamaged state. Differences between these rates were scaled over the areas mapped, to estimate the potential benefits of peatland restoration show in Table 6. Only emissions from the peat itself were used, meaning that carbon sequestered by trees in afforested peatlands has not been accounted for.

In our assessment, significant greenhouse gas benefits could potentially be delivered by reducing cultivation and drainage of peat soils, primarily in the lowlands, and by widespread blocking of grips and gullies in upland blanket bog, in addition to re-vegetating all areas of bare and heavily eroded peat. The estimated benefits of restoration of our entire peatland resource, assuming restoration emissions rates for 10 years followed by emissions rates for undamaged peatlands for 30 years, are presented in Table 6.

Some of these emissions savings could be delivered by lowering the intensity of farming, allowing the water table to be raised. Conversion of arable land to grassland, involving raising the water table by 20cm could reduce emissions from peat by 5.9 tonnes CO_2-e per hectare a year. Modest benefits could be achieved on a smaller scale through wider uptake of measures such as grass buffer strips, field corner management and reducing the depth and frequency of tillage. Without conversion to peat forming wetlands, however, the peat carbon store will continue to be lost, albeit at a slower rate.

An important caveat to the above estimate is the consideration of 'leakage': displacing an activity to cause new emissions elsewhere. It is vital that efforts to reduce greenhouse gas emissions from agriculture in England do not transfer production to pristine habitats overseas or to other peat soils in the UK with no net benefit to mitigation. Clearly, the reversion of significant areas of agricultural land to wetland would have the potential to result in leakage as well as risking other important services, including food security.

It will therefore be essential that consideration of leakage is integral to any wide-scale programme of peatland restoration. Natural England understands the importance of this issue and has commissioned a study to examine the contributions of lowland peatlands to food security and to compare these with the benefits of restoration.

Cost benefit analysis of restoration

Peatland restoration costs money to implement and can prevent the continuation of current land uses. Farming peatlands can be highly profitable, so restoration is likely to result in potentially significant losses of income. A re-wetted peatland can also involve ongoing management costs relating to grazing, scrub clearance and water management. To understand the value of implementing peatland restoration we need to be able to compare the estimated emissions benefits above with direct and indirect costs of peatland restoration.

We have carried out an initial cost/benefit analysis on a number of peatland restoration activities. The costs considered were the initial capital cost and the income foregone ('opportunity costs') from the land use change. The direct capital costs of different peatland restoration techniques were taken from a Defra-funded project[43] which collected information on the costs, motivation and

Table 7: Estimated net economic benefit per hectare for a selection of peatland restoration activities from 2010-2050 using the non-traded Shadow Price of Carbon at low, central and high rates (-ve is a net cost).

Restoration Activity	£/ha low SPC (£26/tCO_2e to £100/ tCO_2e)	£/ha central SPC (£52/tCO_2e to £200/ tCO_2e)	£/ha high SPC (£78/tCO_2e to £300/ tCO_2e)
Re-wetting cultivated deep peat	£19,164	£48,066	£78,110
Re-wetting improved grassland on deep peat	£11,221	£32,770	£55,169
Preventing overgrazing	£2,415	£5,690	£9,095
Reseeding of bare peat	£1,669	£4,892	£8,242
Stabilisation of bare peat	£507	£3,730	£7,080
Blocking grips	-£32	£2,850	£5,844
Planting bare peat	-£459	£2,764	£6,114
Gully Blocking	-£635	£2,246	£5,240
Cessation of moorland burning	-£3,246	£3,266	£10,035
Re-wetting cultivated wasted peat	-£11,129	-£10,274	-£9,385
Re-wetting improved grassland on wasted peat	-£11,364	-£10,727	-£10,064

successes of UK peatland restoration projects. Opportunity costs were calculated using the Higher Level Stewardship (HLS) income-foregone payments for the types of options that deliver restoration activities.

The net economic benefits of each restoration activity was calculated by applying the non-traded Shadow Price of Carbon (SPC) at the low, central and high rates (as per DECC guidelines) to the average estimated emission reductions delivered per hectare per year up to 2050 (Table 7). Under the low SPC, five restoration activities showed a net positive benefit (ie restoration would deliver higher net income than current land use) particularly the restoration of lowland deep peat. This reflects the significant greenhouse gas savings which would appear to more than outweigh the opportunity costs. Under the central SPC, all but two restoration activities deliver a net positive benefit.

It is important to note that these figures are not exhaustive; there may in fact be additional costs that it has not been possible to estimate, particularly in relation to opportunity costs. We recognise that the HLS income foregone model may not be entirely appropriate to some types of restoration such as re-wetting cultivated deep peat.

Further work is needed to develop more detailed and considered 'business cases' for the different types of restoration. This analysis has also only focussed on the carbon benefits from restoration. The wider benefits provided, such as supporting habitats and biodiversity, providing a space for recreation and other cultural services as well as filtering and regulating water, have not been reflected. The potential for some form of 'payment for ecosystem services' is discussed in section 6 of this report.

Although further analysis is needed, our initial CBA has highlighted that most types of peatland restoration are likely to deliver cost-effective emission reductions. Indeed, a number have the potential to deliver net income for land managers on the assumption of a permanently strong price of carbon for which they can receive payment for protecting.

We do, however, recognise that the values given in the DECC guidelines for the Shadow Price of Carbon do not currently match actual trading values, which for the voluntary market are significantly lower (around £4-5 tCO_2-e). The SPC is effectively a policy tool developed to assess the relative cost-effectiveness of different mitigation options and programmes. It is designed to reflect the long-term social and political drivers for the transition to a low carbon economy. The use of the SPC has, however, clearly indicated that the majority of peatland restoration options can be deemed a cost effective means of carbon mitigation.

Restored peatland, such this peat extraction site at Thorne Moors, Yorkshire, can represent good value for money in carbon terms, as well as regenerating wildlife and an attractive peatland landscape