Northern Ireland Assembly

Research and Information Service
Briefing Paper

Paper No. 32/21 05 May 2021 NIAR 117-2021

Peat and Peatlands

Josh Pike

This briefing paper provides information on peat and peatlands across the UK and the Republic of Ireland. It discusses the current extent and conditions of peatlands across the jurisdictions and natural capital and ecosystem services provided by peatlands. The various jurisdictions' national peatland strategies are outlined and peatland restoration efforts are discussed. The role peatlands play in climate change targets are examined and finally future considerations are detailed.

Contents

1 What is peat?

Peat is an organic surface layer within soils, which is comprised of partially decomposing organic material (predominately from plants). The organic material does not fully decompose due to waterlogging, oxygen and nutrient deficiency, and high acidity conditions found in peatlands[1].

2 What are peatlands?

Peatlands are terrestrial wetland ecosystems, which have a net accumulation of peat[2]. The Ramsar Convention defined peatlands as[3]:

> *"Peatlands are ecosystems with a peat deposit that may currently support a vegetation that is peat-forming, may not, or may lack vegetation entirely"*

Peatlands cover 3% of the global land surface yet they are the largest natural terrestrial store of carbon, 450 gigatonnes CO_2 equivalent ($GtCO_2e$), and annually sequester ~0.4 billion tons of CO_2[4].

There are three broad peatland habitats in the UK[5];

- Blanket bog – peatlands which receive all their water from precipitation. They are globally rare, but are the largest UK peatland habitat;
- Raised bog – peatlands which form in low lying areas, typically floodplains or basins. They are often found on the surface of fens, and can be identified by their domes of peat;
- Fens – peatland environments that receive their water from precipitation and groundwater. There are a wide variety of fen-environments.

Additionally peatlands may also be classified as 'upland' and 'lowland'.

3 Current extent and condition of peatlands in the UK

Peatlands occupy 12% of the UK land area, provide over a quarter of the UK's drinking water[6], and is the largest component of the UK's wetland environment. Table 1 provides a summary of the UK's peatland habitats. Current estimates suggest that only 20% of the UK's peatlands remain in a near-natural state[7]. However, there is currently no consistent reference year or scale[8] for peatland extents and conditions across the UK and much of the peat and peatland data is becoming increasing aged (i.e. National

[1] International Peatland Society; https://peatlands.org/peat/ [last accessed 04/05/2021]
[2] International Peatland Society. https://peatlands.org/peatlands/ [last accessed 04/05/2021]
[3] Ramsar Convention (2002) Resolution VIII.11: Additional guidance for identifying and designating under-represented wetland types as Wetlands of International Importance, p.4
[4] HM Treasury (2021), Final report - The Economics of Biodiversity: The Dasgupta Review, p.125
[5] ONS (2019) UK natural capital: peatlands
[6] *ibid*
[7] IUCN (2018) UK Peatland Strategy 2018-2040
[8] England and Wales use a peat depth of 40cm+, Scotland and Northern Ireland use a peat depth of 50cm+

Soil Map compiled by Joint Nature Conservation Committee (JNCC) in 2011[9]). This makes it difficult to assess peat and peatland change over time, and across the UK.

Table 1. Summary of UK peatland habitats. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

Habitat	Hectares	Percentage
Cropland	194,125	7
Forest	439,292	15
Grassland	234,761	8
Bog	1,922,016	65
Fen	27,545	1
Extracted	144,887	5
Total UK	**2,962,626**	**100**

3.1 Northern Ireland

The JNCC National Soil Map[10] indicates that 24.6% of NI is covered by peat. A new peat map was developed by the Centre for Ecology and Hydrology (CEH) in 2017 based on the British Geological Survey (BGS) superficial geology dataset, the Agri-Food and Biosciences Institute (AFBI) soil survey, and the 1988 NI peat survey[11]. The CEH mapping identified a total peat extent of 242,622 ha[12] (figure1).

It is estimated that 86% of NI's peatlands are in a degraded state due to drainage, overgrazing, afforestation, burning and extraction[13]. Table 2 provides a summary of the peatland habitats in NI and their condition.

Table 2. Summary of peatland categories and conditions in NI. A baseline of 2007 was used. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

Peatland habitat and condition (NI 2007)	Percentage
Forest	13.00%
Cropland	1.29%
Drained eroded modified bog	0.89%
Undrained eroded modified bog	1.43%
Drained heather dominated modified bog	2.75%
Undrained heather dominated modified bog	4.41%
Drained grass dominated modified bog	2.75%
Undrained grass dominated modified bog	6.49%
Extensive grassland	0.80%
Intensive grassland	12.88%
Near natural bog	14.80%
Near natural fen	0.00%

[9] JNCC (2011) Report No. 445: Towards an assessment of the state of UK Peatlands
[10] *ibid*
[11] Cruikshank and Tomlinson (1990) 1988 Northern Ireland Peat Survey
[12] CEH (2017) Implementation of an Emissions Inventory for UK Peatlands. A report to the Department for Business, Energy and Industrial Strategy p.24
[13] RSPBNI (2020) Peatland restoration is vital if Northern Ireland is serious about a green recovery [last accesses 04/05/2021]

Extracted domestic peat	36.08%
Extracted industrial peat	0.22%
Rewetted bog	2.07%
Rewetted fen	0.14%
Total (ha)	242,623

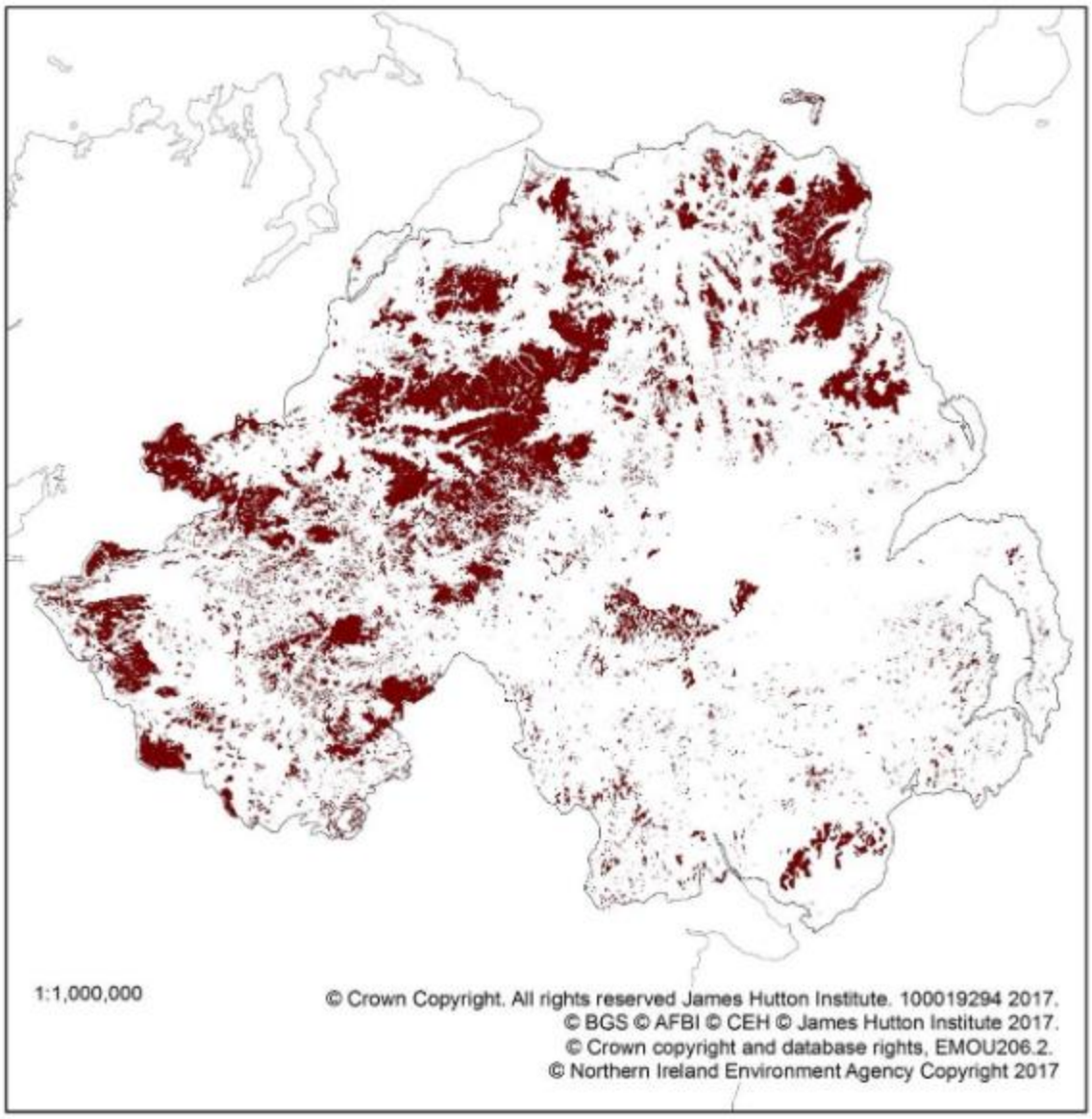

Figure 1. Peat extent in Northern Ireland. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

3.2 England

Peatlands cover 11% of England's land area[14] covering some 682,230 ha[15] (figure 2). Around 30% of England's peatland are in a wasted state (heavily degraded through drainage and cultivation for agriculture)[16].

Less than 1.3% of England's peatlands are in a near-natural state due to considerable peat extraction, grazing, fire and drainage for agriculture, and forestry plantations[17].

Table 3 provides a summary of the peatland habitats in England and their condition.

Table 3. Summary of peatland categories and conditions in England. A baseline of 2013 was used. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

Peatland habitat and condition (England 2013)	Percentage
Forest	9.60%
Cropland	26.78%
Drained eroded modified bog	0.83%
Undrained eroded modified bog	6.39%
Drained heather dominated modified bog	2.82%
Undrained heather dominated modified bog	12.79%
Drained grass dominated modified bog	3.53%
Undrained grass dominated modified bog	5.10%
Extensive grassland	0.28%
Intensive grassland	10.80%
Near natural bog	12.65%
Near natural fen	0.00%
Extracted domestic peat	0.64%
Extracted industrial peat	0.68%
Rewetted bog	3.53%
Rewetted fen	3.60%
Total (ha)	682,201

[14] Natural England (2021) Report NERR094; Carbon storage and sequestration by habitat: a review of the evidence (second edition) p.99

[15] CEH (2017) Implementation of an Emissions Inventory for UK Peatlands. A report to the Department for Business, Energy and Industrial Strategy p.22

[16] *ibid*

[17] *ibid*

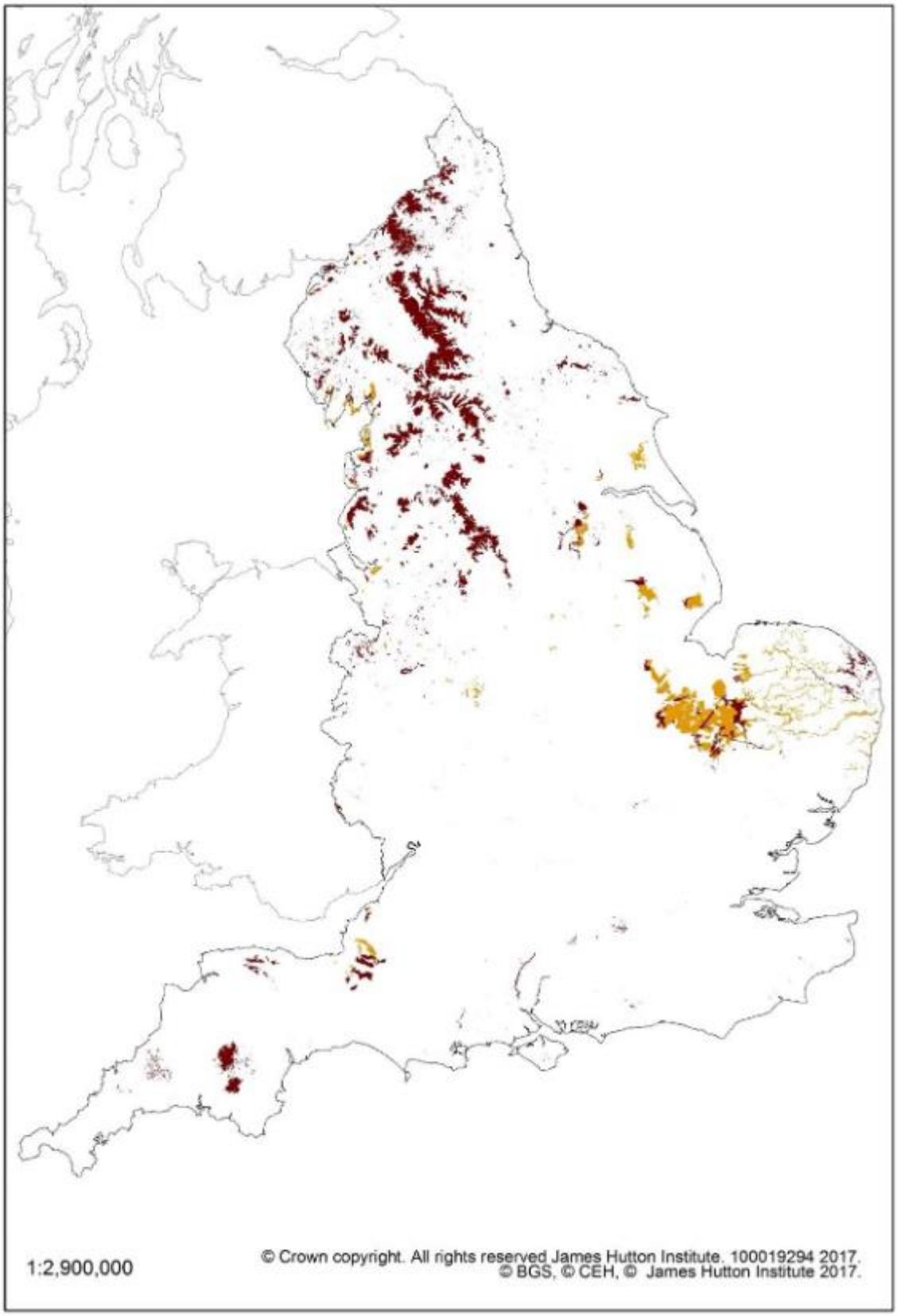

Figure 2. Peat extent in England; Red = peat, Orange = wasted peat. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

3.3 Scotland

Peatlands cover more than 20% of Scotland's land[18], and there are four main natural peatland types in Scotland; blanket bog, raised bog, fen and bog woodland[19]. Blanket bogs are the most extensive peatland habitat in Scotland covering 1.8 million hectares (23% Scotland land area), storing an estimated 1.6 billion tonnes of carbon[20].

It is estimated that 70% of Scottish blanket bogs and 90% of Scottish raised bogs have been damaged in some capacity[21].

CEH noted that there was a lack of high resolution data available for mapping peat soils[22], inhibiting the ability to exactly locate peat deposits. Combining different mapping data sources CEH produced the first unified map of peat presence/absence for Scotland. The total mapped peat area for Scotland was 1,947,750 ha[23] (figure 3). Table 4 provides a summary of the peatland habitats in Scotland and their condition.

Table 4. Summary of peatland categories and conditions in Scotland. A baseline of 1990 was used. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

Peatland habitat and condition (Scotland 1990)	Percentage
Forest	17.08%
Cropland	0.42%
Drained eroded modified bog	3.86%
Undrained eroded modified bog	10.17%
Drained heather dominated modified bog	7.97%
Undrained heather dominated modified bog	21.01%
Drained grass dominated modified bog	1.70%
Undrained grass dominated modified bog	4.48%
Extensive grassland	1.63%
Intensive grassland	4.04%
Near natural bog	25.18%
Near natural fen	0.00%
Extracted domestic peat	2.31%
Extracted industrial peat	0.15%
Rewetted bog	0.00%
Rewetted fen	0.00%
Total (ha)	1,947,750

[18] Scottish Natural Heritage (2015) Scotland's National Peatland Plan: Working for our future
[19] *ibid*
[20] *ibid*
[21] *ibid*
[22] CEH (2017) Implementation of an Emissions Inventory for UK Peatlands. A report to the Department for Business, Energy and Industrial Strategy p.20-21
[23] *ibid*

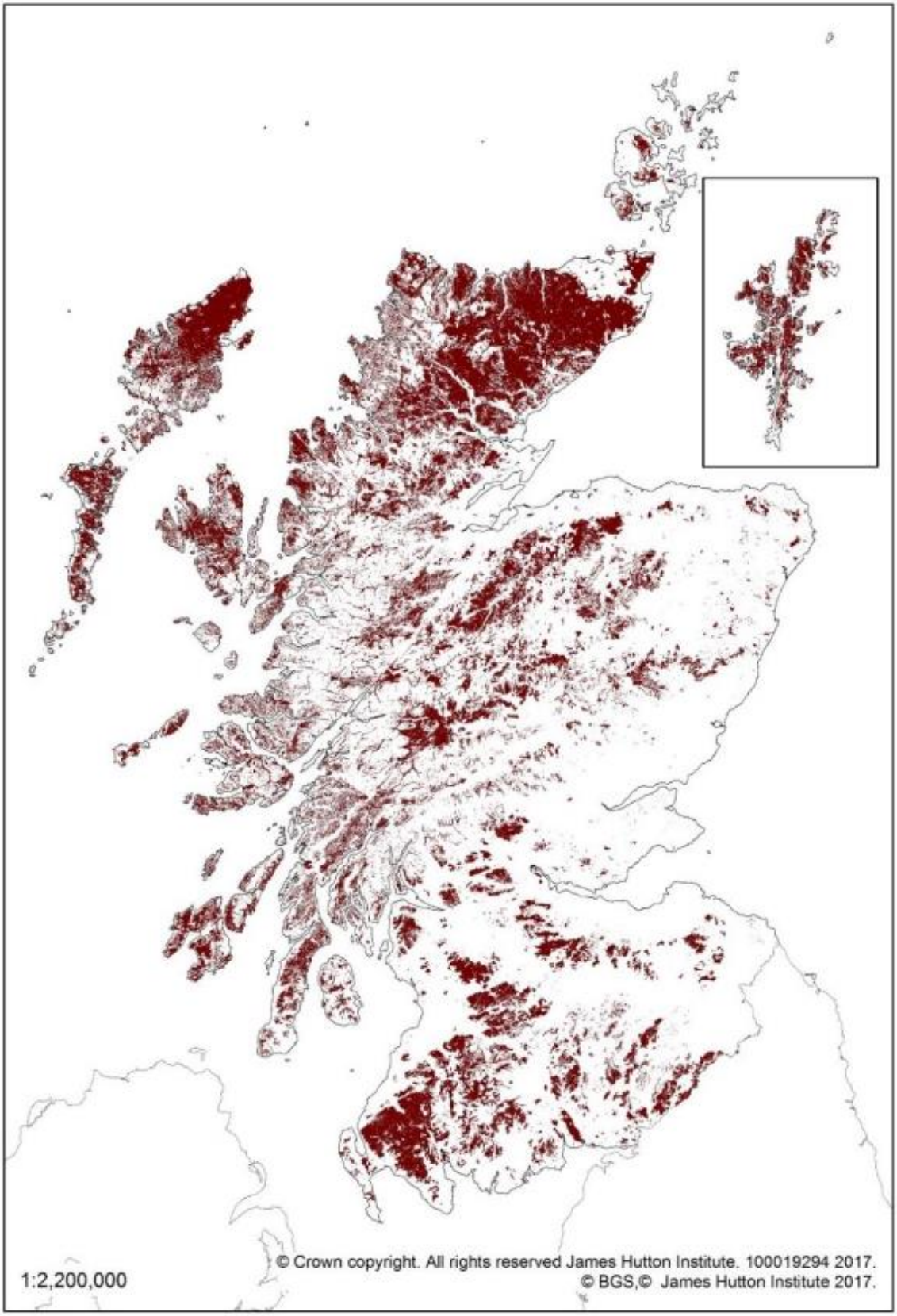

Figure 3. Peat extent in Scotland. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

3.4 Wales

At least 4% of Wales is covered by peatland[24], in both upland and lowland settings. Wales supports the largest expanses of near-natural blanket mire in GB[25].

The total mapped peat area for Wales was 90,050 ha[26] (figure 4). Table 5 provides a summary of the peatland habitats in Wales and their condition. There is limited data for the condition of Welsh peatlands. CEH reported that 23,548 ha (26%)[27] of Welsh peatlands were in a near-natural state, therefore 74% of Welsh peatlands have been damaged to some extent.

Table 5. Summary of peatland categories and conditions in Wales. A baseline of 1990 was used. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

Peatland habitat and condition (Wales 1990)	Percentage
Forest	10.57%
Cropland	0.11%
Drained eroded modified bog	0.02%
Undrained eroded modified bog	0.23%
Drained heather dominated modified bog	1.76%
Undrained heather dominated modified bog	6.93%
Drained grass dominated modified bog	1.76%
Undrained grass dominated modified bog	32.20%
Extensive grassland	9.99%
Intensive grassland	7.30%
Near natural bog	26.15%
Near natural fen	2.97%
Extracted domestic peat	0.00%
Extracted industrial peat	0.00%
Rewetted bog	0.00%
Rewetted fen	0.00%
Total (ha)	90,052

[24] Natural Resources Wales (2020) National Peatland Action Programme, 2020-2025
[25] *ibid*
[26] CEH (2017) Implementation of an Emissions Inventory for UK Peatlands. A report to the Department for Business, Energy and Industrial Strategy p.23
[27] *ibid*

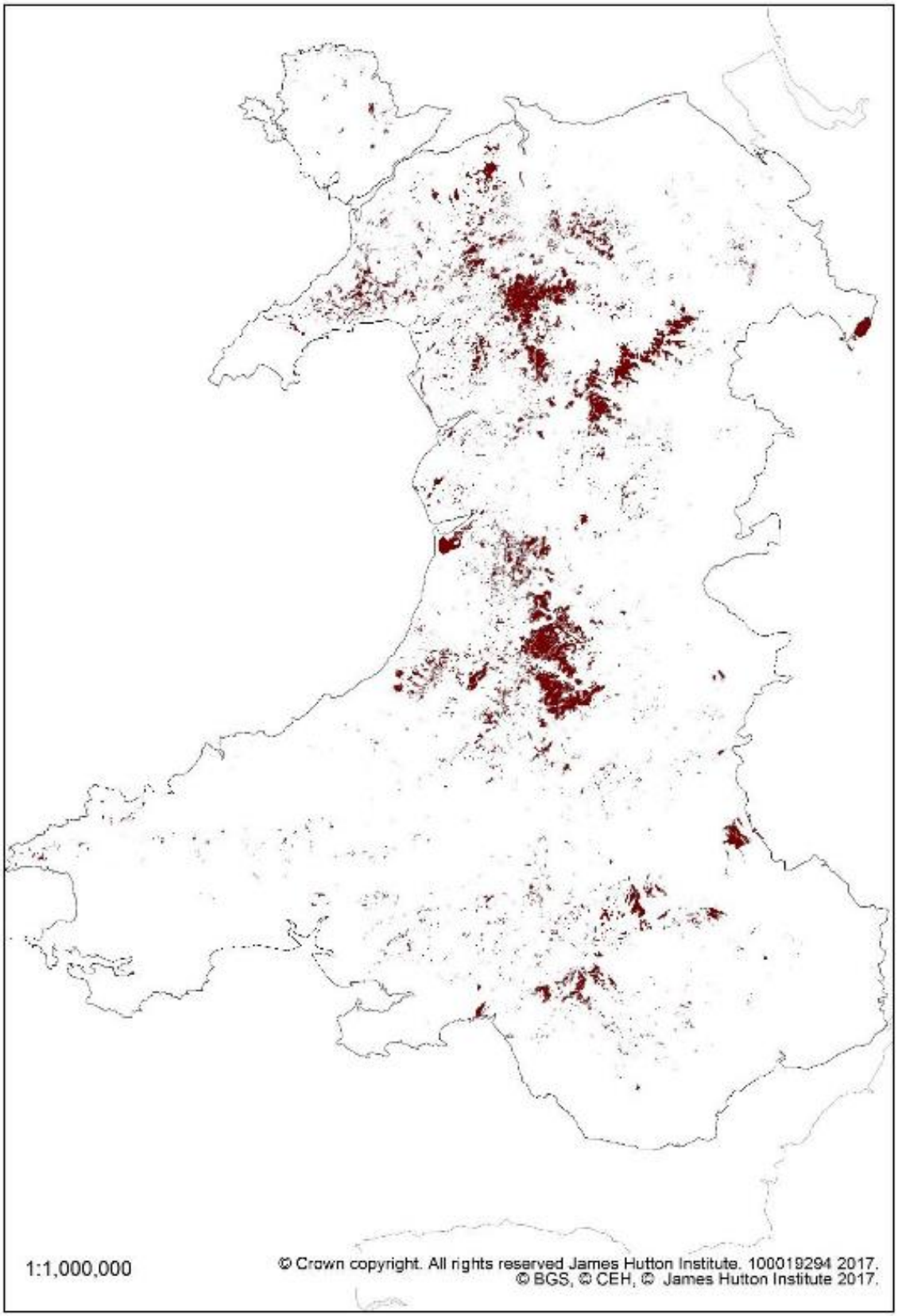

Figure 4. Peat extent in Wales. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

3.5 Republic of Ireland

Peat soils cover ~21% of the RoI, with a total peatland area of 1,564,650 hectares[28] (figure 5). RoI has a comparable peatland coverage to Scotland.

It is estimated that only 10% of raised bogs and 28% of blanket bogs are in a natural state[29].

Table 6 provides a summary of the peatland habitats in RoI and their condition.

Table 6. Summary of peatland categories and conditions in RoI. Source: Department of Arts, Heritage and the Gaeltacht (2015) Managing Ireland's Peatlands: A National Peatlands Strategy 2015

Peatland habitat and condition (RoI)	Percentage
Natural peatlands	17.21%
Cutover peatlands (domestic turf cutting)	39.14%
Afforested peatlands	19.17%
Farmed grasslands	18.85%
Industrial cutaway peatlands	4.47%
Rehabilitated cutaways	1.15%
Total (ha)	1,564,650

[28] Department of Arts, Heritage and the Gaeltacht (2015) Managing Ireland's Peatlands: A National Peatlands Strategy 2015, p. 4

[29] *ibid*

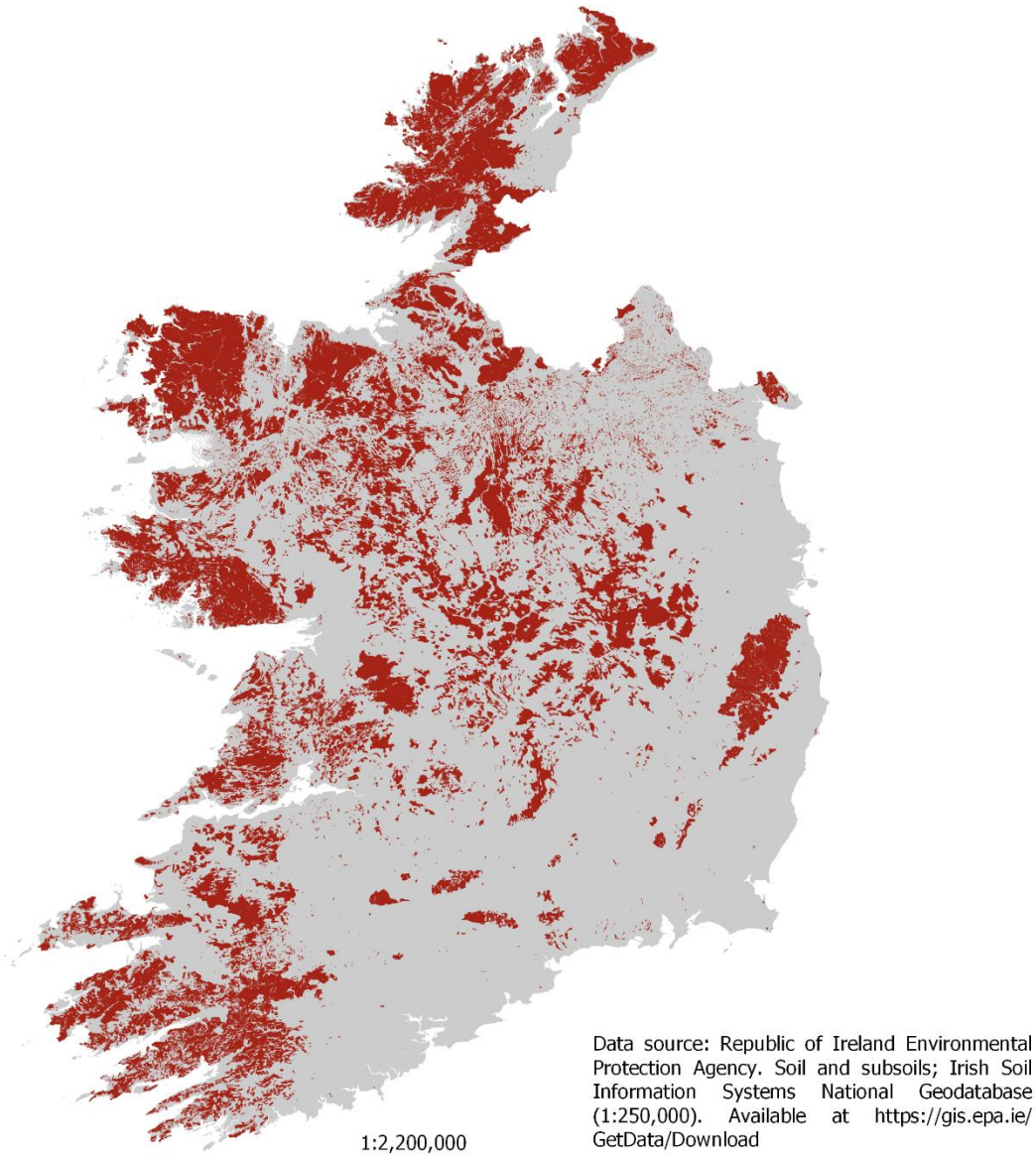

Figure 5. Peat extent in RoI. Data source: RoI EPA Irish Soil Information System National Geodatabase (1:250,000), available at https://gis.epa.ie/GetData/Download

4 Natural capital and ecosystem services

Nature provides the building blocks to sustain life on earth, these goods and services can be thought of in two ways, as natural capital and ecosystem services.

Natural capital places monetary values on assets provided by nature by examining the flow of services provided to people alongside the benefit to society and the cost (or profit) of the service[30].

Ecosystem services are the assets that nature provides to humans. Peatlands provide and regulate a wide variety of ecosystem services[31], which are themselves affected by the health of the peatland.

The value of these assets can be used to create natural capital accounts for different ecosystems.

Below are examples of peatland ecosystem services.

4.1 Peat extraction

Peat continues to be industrially extracted predominately for horticulture usage in the UK[32]. This industrial extraction adds to the UK economy, however income from industrial extraction has declined from £119m in 1997 to £36.2m in 2015[33]. CEH (2017) estimated the change in peatland extraction between 1990 and 2013 (table 7).

Table 7. Area of industrial and domestic peat extraction sites by country in 1990 and 2013. Domestic extraction refers to peat cuttings on blanket bogs for fuel. Industrial extraction refers to cuttings on fens and raised bogs for predominately horticultural use. Source: CEH (2017) Implementation of an Emissions Inventory for UK Peatlands.

Activity	Year	England (ha)	Scotland (ha)	Northern Ireland (ha)
Industrial extraction	1990	7082	2881	761
	2013	4628	2840	503
Domestic extraction	1990	4402	44,923	92,202
	2013	4391	44,649	87,539

Bord na Móna, RoI announced in 2021 that it had formally ended all peat harvesting on its land after having suspended harvesting in 2020[34]. However, Bord na Móna will continue to manufacture peat briquettes to 2024, and continue to operate its horticultural facility supported by existing peat reserves[35].

The UK Government stated in its 25-year environment plan its intention to cease peat in horticultural products by 2030. Additionally in 2010, the then Natural Environment

[30] ONS (2019) UK natural capital: peatlands
[31] Ecosystem services are the benefits provided by an ecosystem to people
[32] ONS (2019) UK natural capital: peatlands
[33] Total income based on 2017 prices; ONS (2019) UK natural capital: peatlands
[34] Bord na Móna (2021) Bord na Móna announce formal end to all peat harvesting on its lands [last accessed 04/05/2021]
[35] *ibid*

Minister Richard Benyon stated his intention to eliminate peat from the amateur market by 2020[36], and although this target was voluntary, it was not met.

A group of gardening experts, conservationists and scientists wrote to the DEFRA minister George Eustice in April 2021, asking the UK to take leadership of the issue, and ban the sale of peat compost by the end of 2021[37].

The Wildlife Trust survey of leading garden retailers and their use of peat based products found that of those who responded (11 out of 20), all offer peat-free composts in their ranges and none sell soil improvers or mulch containing peat. But only Travis Perkins and Wickes declared an end-date for peats sales (2021 and 2025 respectively). B&Q, Hillier and the Blue Diamond group committed to phase out peat sales but gave no date, whereas Asda, Lidl and others have set targets to reduce peat sales but not to end sale. Additionally Asda committed to ending sale of their own-brand peat products by 2030.

In NI, the power to grant permission for industrial peat extraction lies with the planning authorities. DAERA is a statutory consultee, but does not hold information on the location or current and projected extraction rates from approved sites[38].

4.2 Agriculture

Agriculture is one of the most common uses of peatlands. It is estimated that 7% of the UK's total peatland is being used as cropland[39], with the vast majority of farmed peatland in England[40]. To enable peatlands to be used for agricultural purposes, modification needs to occur, typically in the form of cutting drainage channels. This leads to peat wastage of 10-30 mm per year[41].

38% of England's lowland peatlands are currently managed for intensive agriculture[42], and are highly profitable. 90% of East Anglian farmlands are on fens, they make up less than 4% of England's farmed area but contribute more than 7% of the total agricultural production, worth £1.23bn to the UK economy[43].

However, ~7600 kilotonnes CO_2 per year ($ktCO_2\ yr^{-1}$) are estimated to be emitted from farmed peatlands, or 32% of all greenhouse gas emissions from peatlands[44].

[36] DEFRA (2010) Press release: Government calls for peat to be phased out
[37] Peatfree (2021) Letter to Secretary of State for the Environment, Food and Rural Affairs [last accessed 04/05/2021]
[38] Northern Ireland Assembly (2021) DAERA Minister's answer to written question 16008/17-22. Available at http://aims.niassembly.gov.uk/questions/search.aspx
[39] Office for National Statistics July 2019; UK natural capital: peatlands
[40] CEH (2017) Implementation of an Emissions Inventory for UK Peatlands. A report to the Department for Business, Energy and Industrial Strategy
[41] Graves and Morris (2013) Restoration of fen peatland under climate change. Report to the adaptation sub-committee of the Committee on Climate Change
[42] DEFRA (2020) England Peat Strategy: Policy Discussion Document
[43] *ibid*
[44] CEH (2017) Implementation of an Emissions Inventory for UK Peatlands. A report to the Department for Business, Energy and Industrial Strategy

The Committee on Climate Change (CCC) has advised NI that there will need to be a substantial change in farming approaches, allowing greater forestation as well as an increase in lower carbon intensive practices[45] to reduce emissions in the agricultural sector.

4.3 Carbon sequestration and storage

It is vital to understand the condition of peatlands as they are capable of being major carbon stores for thousands of years. However, peatlands in a poor condition turn from being net carbon sinks to net carbon sources. Table 8 shows the impact of peatland degradation on greenhouse gas emissions.

A near natural bog can remove ~3.5 tonnes CO_2 per hectare per year ($tCO_2\ ha^{-1}\ yr^{-1}$), whereas a near natural fen can remove ~5.5 $tCO_2\ ha^{-1}\ yr^{-1}$[46]. Therefore the 20% of UK peatlands in a near natural state, are currently sequestering 1800 $ktCO_2\ yr^{-1}$. The remaining 80% of peatlands in various stages of degradation will either be reducing the amount of carbon it can sequester or becoming carbon sources, emitting their stored carbon.

It is estimated that UK peatlands currently store more than 3 billion tonnes of carbon, this is same as all carbon stored in the forests of the UK, Germany and France combined[47].

There is debate about how peatlands will respond to climate change[48]. Scientists are able to extract information about how peatlands responded to past climatic changes by investigating deep peat deposits. Much of the peat deposited in the UK has been forming since the last ice age, enabling a record of the past 10,000 years. These past climate records indicate that at high-latitudes peatlands will increase their carbon sequestration capacity, as long as they are not degraded[49]. This would create a 'negative feedback' whereby peatlands take in carbon reducing future warming.

[45] CCC (2019) Reducing emissions in Northern Ireland

[46] CEH (2017) Implementation of an Emissions Inventory for UK Peatlands. A report to the Department for Business, Energy and Industrial Strategy

[47] BBC (2020) Climate Change: UK peat emissions could cancel forest benefits [last accessed 04/05/2021]

[48] Loisel, L *et al.,* (2021) Expert assessment of future vulnerability of the global peatland carbon sink. Nature Climate Change, 11, p. 70-77

[49] Gallego-Sala, A *et al.,* (2018) Latitudinal limits to the predicted increase of the peatland carbon sink with warming. Nature Climate Change, 8, p. 907-913

Table 8. Emission factors for peat condition types (all measured in $tCO_2e\ ha^{-1}\ yr^{-1}$). Note that negative (positive) values indicates net greenhouse gas removal (emission). A. Tier 1 default emission factor; B. Tier 2 emission factor; C. Tier 3 emission factor (CARBINE model 1990-2019 implied factor). Source: Natural England (2021) Report NERR094; Carbon storage and sequestration by habitat: a review of the evidence (second edition) p.105

Peat condition	Drainage status	Direct CO_2[a,b,c]	CO_2 from dissolved organic carbon [a]	CO_2 from particulate organic carbon[b]	Direct CH_4[a,b]	CH_4 from ditches[a]	Direct N_2O[a,b]	Total
Forest	Drained	2.52 to -1.79[c]	1.14	0.3	0.06	0.14	1.31	**5.46 to 1.15**
Cropland	Drained	28.60	1.14	0.3	0.02	1.46	6.09	**37.61**
Eroding modified bog (bare peat)	Drained	6.18	1.14	5.0	0.14	0.68	0.14	**13.28**
	Undrained	6.18	0.69	5.0	0.15	0	0.14	**12.17**
Modified bog (semi-natural Heather and grass dominated)	Drained	0.13	1.14	0.3	1.26	0.66	0.06	**3.54**
	Undrained	0.13	0.69	0.1	1.33	0	0.06	**2.31**
Extensive grassland (bog and fen)	Drained	6.96	1.14	0.3	1.96	0.66	2.01	**13.03**
Intensive grassland	Drained	21.31	1.14	0.3	0.68	1.46	2.67	**27.54**
Rewetted bog	Rewetted	-0.69	0.88	0.1	3.59	0	0.04	**3.91**
Rewetted fen	Rewetted	4.27	0.88	0.1	2.81	0	0	**8.05**
Rewetted modified (semi-natural) bog	Rewetted	-3.54	0.69	0	2.83	0	0	**-0.02**
Near natural bog	Undrained	-3.54	0.69	0	2.83	0	0	**-0.02**
Near natural fen	Undrained	-5.41	0.69	0	3.79	0	0	**-0.93**
Extracted domestic peat	Drained	10.27	1.14	1.01	0.14	0.68	0.14	**13.37**
Extracted industrial peat	Drained	6.18	1.14	5.0	0.14	0.68	0.14	**13.28**
Settlement	Drained	0.07	0.57	0.15	0.63	0.16	0.03	**1.61**

4.4 Drinking water

Up to 70% of UK drinking water is sourced from peatland dominated upland catchments[50]. Most of these catchments have been subjected to drainage, forestry plantation and burn-management, leading to the degradation of peatlands causing, or at least aiding, the increase of dissolved organic carbon (DOC) within UK water[51].

DOC levels in water are important for water treatment. Higher levels of DOC cause colour (brown water), odour and taste issues, require increasing water treatment. Over the last 30 years, DOC levels have doubled in many UK catchments[52], and evidence has found that typical treatment methods used in the UK are becoming less efficient, increasing costs, and potential creating the need for new treatment procedures[53].

Many UK water companies have begun prioritising investment in peatland restoration to aid in reducing treatment costs;

- United Utilities have invested £10.6m across 27,000 hectares through its Sustainable Catchment Management Programme (SCaMP); and
- The Source to Tap INTERREG VA funded (€4.9m) forest-to-peatland restoration project is being led by NI Water. The project at Tullychurry aims to restore ~32 ha of previous commercial conifer plantation to a functioning bog. The project is funded by the European Union's INTERREG VA programme, DAERA, and the Department for Housing, Planning and Local Government, in the RoI. The project is due to finish in 2021.

4.5 Biodiversity

Peatlands are home to a wide variety of habitats, plants and animals, some of which are designated as rare, threatened or in decline. Species that are in decline, rare and/or of UK/all-Ireland importance may be designated a priority species.

The Northern Ireland Priority Species List is currently under review by DAERA, with the revised Priority Species list available in stages (spring 2020, autumn 2020, and potentially additional phase in 2021[54]). The current Priority Species list published in 2010 include many species reliant on peatlands, these include;

- Dunlin (bird);
- Golden Plover (bird), estimated only 10-20 breeding pairs are left in NI[55];

[50] Natural England (2009) NE209: Mapping values: the vital nature of our uplands – an atlas linking environment and people
[51] Williamson, J *et al.,* (2020) Will UK peatland restoration reduced dissolved organic matter concentrations in upland drinking water supplies? Hydrology and Earth System Sciences Discussion [preprint]
[52] Yallop, A. *et al.,* (2010) Increase in humic dissolved organic carbon export from upland peat catchments: the role of temperature, declining sulphur deposition and changes in land management. Climate Research, 45, p. 43-56
[53] Worral, F and Burt, T (2009) Changes in DOC treatability: indications of compositional changes in DOC trends. Journal of Hydrology, 366 p.1-8
[54] DAERA, Northern Ireland Priority Species [last accessed 04/05/2021]
[55] Ulster Wildlife, Wildlife of our Peatlands [last accessed 04/05/2021]

- Hen Harrier (bird), NI supports the only tree nesting population in the world[56];
- Large Heath (butterfly);
- Desmoulin's whorl snail (mollusc), identified in 2018 for the first time in NI[57];
- Bog rosemary (vascular plant); and
- Marsh saxifrage (vascular plant)

Peatland habitats in the UK are often protected by statutory designations to protect rare animals, plants, or geological features (table 9). Peatlands may be designated as Special Areas of Conservation (SACs), Site of Special Scientific Interest (SSSI) in GB, Areas of Special Scientific Interest (ASSI) in NI, and Ramsar.

SACs are protected sites under the European Council's Habitats Directive (92/43/EEC), and in the UK this is designated under the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales, the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) in Scotland, the Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended) in NI, and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) in the UK offshore area. There are over 1000 animal and plant species, and 200 habitat types, including peatlands, are listed in the directives annexes.

ASSIs, and their GB counterpart (SSSIs) are protected areas that represent the best areas of wildlife and geology[58]. They are designated under the Wildlife and Countryside Act 1981 (as amended) in England and Wales, the Nature Conservation (Scotland) Act 2004 in Scotland, and the Wildlife and Natural Environment Act (Northern Ireland) 2011 in NI.

Ramsar sites are wetlands of international importance, designated under the criteria of the Ramsar Convention on Wetlands, and contain representative, rare or unique wetland types or for their biodiversity. Whilst there is no dedicated legislation for the protection of Ramsar sites in the UK, Ramsar sites are typically also designated under SACs or SSSIs/ASSIs.

Table 9. Summary of statutory designations. Data sources 1. DAERA, protected areas; 2. JNCC, Special Areas of Conservation; 3. Natural England, Designated Sites View; 4. NatureScot, Sites of Special Scientific Interest; 5. NatureScot, Ramsar Sites; 6. Natural Resources Wales, Protected areas of land and seas

Country	SACs	SSSIs/ASSIs	Ramsar
Northern Ireland[1]	57	394	20
England[2,3]	242	4123	73
Scotland[2,4,5]	238	1422	51
Wales[2,6]	85	1023	10

[56] Ulster Wildlife, Wildlife of our Peatlands [last accessed 04/05/2021]
[57] Belfast Telegraph (2018) Rare species of snails found in Co Down for the first time
[58] DAERA, Areas of Special Scientific Interest [last accessed 04/05/2021]

The UK was the first country to produce a national biodiversity action plan[59], in 1994. This was a response to the 1992 Convention on Biological Diversity (CBD), which called for the development and enforcement of national strategies and associated action plans to identify, conserve and protect existing biological diversity, and enhance it wherever possible[60]. In 2012 the UK Post-2010 Biodiversity Framework was published in response to the 2010 CBD Strategic Plan for Biodiversity 2011–2020 and its 20 Aichi Targets. The UK Post-2010 Biodiversity Framework ran from 2010-2020.

In NI, the NI Biodiversity Group was set up to advise the UK Government on how best to apply the UK Post-2010 Biodiversity Framework. DAERA published its Biodiversity Strategy for Northern Ireland to 2020, in 2015 to meet its international obligations and local targets to protect NI biodiversity. The implementation plan for the NI biodiversity strategy, lists 57 actions with associated target dates, with the overarching objective to have completed all actions by 2020. However, a RSPB NI review stated that 83% of the commitments set out in the Biodiversity strategy have not been adequately met[61].

5 National Peatland Strategies

5.1 The UK peatland strategy 2018-2040

The International Union for Conservation of Nature (IUCN) UK National Committee published the UK Peatland strategy in 2018, with a primary target of two million hectares of peatland in good condition, under restoration or being sustainably managed by 2040[62]. The UK Strategy (Annex 1) encompasses all peatlands in the UK, and sets the context for the devolved administrations strategic peatland action plans, and acts a baseline to measure progress. The UK peatland strategy is non-statutory.

The strategy is divided into six goals; Conservation, Restoration, Adaptive Management, Sustainable Management, Co-ordinate, and Communicate. Each of the goals has their own objectives, outcomes and milestones for 2020, 2030 and 2040 (see Annex 1 for a full breakdown).

Progress reports for the UK peatland strategy are to be delivered every five years, the first progress report will be delivered in 2023.

5.2 Northern Ireland

There is currently no national peatland strategy for NI, however the DAERA Minister, Edwin Poots, has stated that a NI peatland strategy is being developed[63].

[59] JNCC, UK Biodiversity Action Plan [last accessed 04/05/2021]
[60] JNCC, UK Biodiversity Action Plan [last accessed 04/05/2021]
[61] RSPB NI (2020) Northern Ireland Biodiversity Strategy failing after years of inaction [last accessed 04/05/2021]
[62] IUCN (2018) The UK Peatland Strategy 2018-2040, p. 12
[63] Northern Ireland Assembly (2021) DAERA Minister's answer to written question 16008/17-22. Available at http://aims.niassembly.gov.uk/questions/search.aspx

5.3 England

There is currently no national peatland strategy for England. However, in the 25-year environment plan, an England peatland strategy was stated to be published in late 2018, however this was missed. DEFRA were expected to publish the strategy in 2020, but this was delayed.

DEFRA's England Peat Strategy: Policy Discussion Document offers an insight into the strategic direction the forthcoming strategy will take;

- Bring all peatland into good condition, Restoration management or more sustainable management by 2040;
- Secure peatlands' carbon store and ensure their contribution towards the Net Zero 2050 target;
- Restore peatlands to deliver Natural Flood Management outcomes
- Bring 75% of SSIs into favourable condition;
- Increase the abundance or distribution of peatland species, and their resilience to move and adapt to climate change, through the restoration of connections and networks of peatland habitats
- Consult on measures to phase out the use of peat in horticulture, prioritising measures in the amateur sector

To achieve the strategy DEFRA notes the need for better information (comprehensive mapping and modelling of peatlands, monitoring and evaluation) and knowledge exchange, empowering stakeholders and supporting planning and implementation[64].

5.4 Scotland

Scotland was the first of the UK legislatures to publish a national peatland strategy in 2015; Scotland's National Peatland Plan: Working for our future. Scotland's peatland strategy's principle aim is to "Protect, manage and restore peatlands to maintain their natural functions, biodiversity and benefits"[65].

By 2020 Scotland's strategy aimed to[66];

- See improvements in the protection and condition of peatlands;
- Peatlands be valued by all stakeholders, and not seen just as special interest habitats;
- The public to embrace peat-free compost;
- Public funding the main source of support for peatland management and restoration, and increase levels of private funding;
- Create a network of 'good management' sites
- Establish a Peatland Code;

[64] DEFRA (2020) England Peat Strategy: Policy Discussion Document
[65] NaturaScot (2015) Scotland's National Peatland Plan: Working for our future, p. 6
[66] *ibid*, p. 4

- Peatland management included in national carbon accounting;
- All statutory protected sites should be in, or moving towards, favourable condition; and
- The Flow Country to be inscribed as a World Heritage Site[67]

5.5 Wales

In November 2020, Wales published its first National Peatland Action programme; National Peatland Action Programme, 2020-2025. The programme aims to deliver 600-800 ha of peatland restoration per year, and outlines six priority areas for action over the next five years[68];

- Peatland erosion;
- Peatland drainage;
- Sustainable management of blanket peats;
- Sustainable management of lowland peats;
- The restoration of afforested peatlands, and;
- The gradual restoration of Wales' highest carbon emitting peatlands

The Welsh Government's long-term Peatland Policy[69] is to produce a map and baseline assessment of peatlands in Wales (expected April 2021), ensure "all peatlands with semi-natural vegetation are subject to favourable management/restoration (a minimum estimated area of 30,000 ha)"[70] and restoring "a minimum of 25% (~c. 5,000 ha) of the most modified areas of peatland"[71].

5.6 Republic of Ireland

RoI published its national peatland strategy in 2015; Managing Ireland's Peatlands: A National Peatlands Strategy 2015. The 10 year strategy consists of 25 principles and 32 actions encompassing forestry, management of publicly owned lands, after-use of industrial cut-overs and formerly forested peatlands, climate change, responsible exploitation, restoration and rehabilitation, and water quality and flooding[72].

In addition to the national peatland strategy, RoI formed the independent Peatlands Council in 2011, to assist the Government and stakeholders around issues of peatland management.

[67] UNESCO, Tentative Lists; Flow Country [last accessed 04/05/2021]
[68] Natural Resources Wales (2020) National Peatland Action Programme, 2020-2025
[69] Welsh Government (2019) Decision reports: 2019 - Welsh Government Peatland Policy
[70] Natural Resources Wales (2020) National Peatland Action Programme, 2020-2025
[71] *ibid*
[72] Department of Arts, Heritage and the Gaeltacht (2015) Managing Ireland's Peatlands: A National Peatlands Strategy 2015

6 Peatland restoration

Peatland restoration predominately centres on the 're-wetting' of the peat. There are numerous techniques employed to re-wet peatlands that include; blocking ditches and gullies, removal of scrub and forests and cessation of extraction and agriculture[73].

The Office for National Statistics estimated the monetary benefit, for greenhouse gas emissions solely, for restoring 55% of the UK's peatlands (based on the CCC's suggestion[74]) to a good state to at least £45-51 billion over the next century[75].

Whilst there is a need to improve and restore the UK's peatland habitats, consideration must also be given as to whether it is economically viable to end all current land use on a peatlands and instead use a holistic approach whereby economically profitable land implements sustainable management practices that reduce harm to peatlands, and other peatlands are restored.

6.1 Northern Ireland

Approximately 1% of NI's peatlands have been restored in the past 30 years[76].

DAERA have committed to the following initiatives to support the restoration of peatland habitats and ecosystems in NI[77];

- The Environment Fund and its Challenge Funds - A Green Recovery Challenge Fund is under development for 2021/22;
- The development of a Resilient Peatland Programme;
- The development of future Agri-Environment schemes;
- The implementation of the "Forests for our Future" programme; and
- The development of new EU Peace Plus Programme 2021-27

The Dungonnell Blanket Bog Catchment Management Plan is being led by NI Water on the Dungonnell Reservoir, Cargan. The Dungonnell Reservoir is within the Garron Plateau peatland, the most extensive area of intact blanket bog in NI[78]. This area is an ASSI, SAC, Special Protection Area (SPA) and a Ramsar site, due to the Garron Plateau being the only site in NI to contain NI Priority Species marsh saxifrage (butterfly) and bog orchid[79]. The Garron plateau peatland is the catchment area for the Dungonnell Reservoir, owned by NI Water, which supplies drinking water to the Ballymena and Moyle areas (~37,000 homes)[80].

[73] IUCN (2019) The State of UK Peatlands: an update
[74] CCC (2019) Net Zero: The UK's contribution to stopping global warming, p. 147
[75] ONS (2019) UK natural capital: peatlands
[76] RSPBNI (2020) Peatland restoration is vital if Northern Ireland is serious about a green recovery [last accesses 04/05/2021]
[77] Northern Ireland Assembly (2021) DAERA Minister's answer to written question 14907/17-22. Available at http://aims.niassembly.gov.uk/questions/search.aspx
[78] IUCN National Committee UK, Dungonnell Blanket Bog Catchment Management Plan [last accessed 04/05/2021]
[79] *ibid*
[80] *ibid*

Overgrazing and artificial drainage have caused the degradation of the peatland surrounding the Dungonnell Reservoir, as such the Dungonnell Blanket Bog Catchment Management Plan aims to;

- Block artificial drains to re-establish a high water table and re-wet the bog; and
- Manage grazing levels and stocking density

So far 15km of drains have been blocked, restoring 72 hectares of blanket bog. The project is aiming to restore an additional 444 hectares of peatland by blocking 41 km of artificial drainage channels, by 2021[81].

6.2 England

Around 22% of England's peatlands are under restoration management[82].

A £10m Peatland Grant is funding the restoration of 6,000 hectares of peatland in England[83], and in March 2020, the Chancellor of the Exchequer announced the UK Governments intention to restore 35,000 ha of peatland by 2025, funded through the Nature for Climate Fund (£640m)[84].

DEFRA have set up a Lowland Agricultural Peat Task Force (LAPTF)[85] to identify solutions with local stakeholders and build these into future Environmental Land Management Schemes (The Landscape Recovery and Local Nature Recovery schemes are to be introduced from 2024[86]).

The Moors for the Future Partnership's (MFFP) MoorLIFE 2020 project aims to restore and protect 95 km^2 of active blanket bog within the South Pennine Moors SAC[87]. The project began in 2015 and was funded by the EU LIFE programme and co-financed by Severn Trust, Yorkshire Water and United Utilities. The project aims include[88];

- Stabilise and re-vegetate bare peat;
- Installing 15,000 min-dams in drainage channels to rewet the blanket bog;
- Planting over 2.6 million sphagnum moss plugs;
- Control invasive species (e.g. rhododendron);
- Set up field labs to monitor restoration efforts;
- Use aerial imagery to produce relevant mapping products;
- Produce a carbon audit report to measure the carbon emitted and stored throughout the conservation work; and

[81] IUCN National Committee UK, Dungonnell Blanket Bog Catchment Management Plan [last accessed 04/05/2021]
[82] Natural England (2021) Report NERR094; Carbon storage and sequestration by habitat: a review of the evidence (second edition), p. 99
[83] CCC (2020) Policies for the sixth carbon budget and net zero, p. 154
[84] UK Government (2020) Budget 2020: 1.69 Natural environment and 2.17 Natural environment
[85] DEFRA (2020) New chair to lead task force on sustainable farming on peatlands [last accessed 04/05/2021]
[86] DEFRA (2021) Environmental Land Management scheme: overview
[87] Moors for the Future Partnership, MoorLIFE 2020 [last accessed 04/05/2021]
[88] *ibid*

- Create a database to record moorland wildfires in the area

In the 2019-2020 season, the MoorLIFE 2020 project installed 6881 mini-dams, planted 9.89 km^2 of sphagnum and removed 6.18 km^2 of invasive species[89].

The MoorLIFE 2020 project end date is February 2022.

6.3 Scotland

The Scottish Government, in the 2020-2021 budget announced a commitment to invest £250 million in peatland restoration (220,000 hectares restored) over the next ten years[90]. This investment aims to enhance biodiversity, secure jobs in the rural economy and deliver GHG emission reductions of up to 0.8 megatonnes (Mt) a year by 2032[91].

Scotland are preparing a statutory ban on burning on peatland, except under licence for strictly limited purposes (i.e., approved habitat restoration), and are working towards a ban on peat used in horticulture[92].

The Peatland ACTION project has been operational since 2012 and has so far undertaken restoration efforts on 25,000 hectares of Scottish peatlands[93]. The Peatland ACTION fund primarily supports on-the-ground peatland restoration activities such as, installing peat dams in man-made ditches to increase water levels, and peat hag (bare peat) re-vegetation to stabilise bar, eroding peat[94]. Before restoration work can be conducted, both peat depth and the condition of the peat is needed to be able to estimate the potential carbon storage and greenhouse gas emissions of the peatland habitat[95].

Currently single year and multi-year projects are eligible to apply to a £22 million fund to undertake restoration projects[96].

6.4 Wales

Funding from the European Union's Agricultural fund for rural development and the Welsh Government's through the Sustainable Management Scheme has enabled the Snowdonia National Park Authority to lead a £1m partnership project to aid in bringing Welsh peatlands into sustainable management[97].

[89] Moors for the Future Partnership, MoorLIFE 2020: conservation works [last accessed 04/05/2021]
[90] Scottish Government (2020) Scottish Budget 2020-2021 statement
[91] *ibid*
[92] Scottish Government (2021) Rural and Environment blog: Restoring our peatlands is a huge win for Scotland [last accessed 04/05/2021]
[93] NatureScot, Peatland ACTION Project [last accessed 04/05/2021]
[94] NatureScot, Peatland ACTION – Fund – How to apply [last accessed 04/05/2021]
[95] *ibid*
[96] Scottish Government (2021) News: Peatland restoration fund tackles global climate crisis [last accessed 04/05/2021]
[97] Snowdonia Park Authority, Welsh Peatlands Project [last accessed 04/05/2021]

The aims of this scheme are[98];

- To improve the condition of Wales' peatlands through restoration and management;
- Develop Peatland Code projects
- Promote best practice in restoration and management by providing accredited training and education;
- Increase awareness and enjoyment of peatlands; and
- Improve the evidence base and enable targeted restoration efforts by improving mapping, reporting, monitoring and research efforts

Through this project, 5000 m of eroding peat haggs (bare peat) on the Carneddau Mountains, and 7000 metres of peat haggs in the Brecon Beacons have been re-profiled and re-vegetated[99]. Additionally 6000 metres of drain channels on the Carneddau Mountains, and 500 metres in the Brecon Beacons have infilled with mini-dams, to aid in rewetting the peatland habitat[100].

6.5 Republic of Ireland

In the 2020 budget, €5 million was allocated to aid in the acceleration of peatland restoration[101], and additional €5 million was allocated in the 2021 through the Carbon Tax Investment Programme[102].

The National Peatlands Strategy progress report 2018 and 2019 reported that the Environment Protection Agency invested around €1 million in peatland-related research projects. The Department of Culture, Heritage and the Gaeltacht operated a pilot Peatlands Community Engagement Scheme in 2018, 4-peatland community led initiatives promoted awareness and conservation of raised bogs[103]. In 2019 the scheme offered a total of €131,000 in funding to 13 initiatives[104]. The scheme has been renewed for 2020-2021[105].

The European Commission has provided €10 million towards the seven year Peatlands and People project through the European Union's LIFE programme[106]. The Peatlands and People project aims to establish a peatlands knowledge centre of excellence, a just transition accelerator programme, and create an immersive people's discovery attraction[107].

[98] Snowdonia Park Authority, Welsh Peatlands Project [last accessed 04/05/2021]
[99] Snowdonia Park Authority, Restoration and Management [last accessed 04/05/2021]
[100] *ibid*
[101] Irish Government (2020) The Budget in Brief: A Citizen's Guide to Budget 2020, p. 18
[102] Irish Government (2021) The use of Carbon Tax Funds 2021
[103] Department of Culture, Heritage and the Gaelacht (2020) National Peatlands Strategy: Progress Report 2018 and 2019, p. 4
[104] *ibid*
[105] National Parks and Wildlife Service, Peatlands Community Engagement Scheme Funding 2020-2021 [last accessed 04/05/2021]
[106] Bord na Móna (2021) Irish peatlands central to a new EU-funded climate action initiative [last accessed 04/05/2021]
[107] *ibid*

6.6 The Peatland Code

The Peatland Code, established in 2017, is an example of natural capital financing, through a voluntary certification scheme for restoration projects, similar to the Woodland Carbon Code. Emission factors are set out in the code which are verifiable and validated. It is currently the only approved scheme for purchasing and reporting carbon credits for peatlands in the UK.

There are currently 28 peatland restoration projects (table X) listed under the Peatland Code (table 10)[108]. However only four projects have so far been validated, two in Wales and two in Scotland.

There are currently no projects (validated or under development) listed for NI.

Table 10. Peatland Code projects. Source: Peatland Code public registry

Projects	Wales	Scotland	England	Combined
Validated	2	2	0	4
Under development	4	14	6	24
Total	6	16	6	28

7 Peatlands and climate change targets

Peatland greenhouse gas emissions are likely play an integral role in the ability of countries to achieve net zero, due to peatlands acting as either net carbon sinks or sources.

In January 2021, peatlands were added to the UK greenhouse gas emissions inventory, causing a 3.5% increase to national emissions (prior to addition, 2.3% increase was reported against the 1990 baseline)[109]. The CCC estimated that the inclusion of peatland emissions to the inventory could increase the total assessment of emissions from NI by 10%[110].

The CCC's Sixth Carbon Budget, The UK's path to Net Zero note that land sector emissions in the UK for 2018 were 12.8 $MtCO_2e$, around 2% of the UK's greenhouse gas emissions. To achieve Net Zero by 2050, the CCC note the critical need for full restoration of upland peat by 2045 (or stabilisation if too degraded to enable complete restoration), and the re-wetting and sustainable management of 60% of lowland peat by 2050[111]. This would deliver annual saving of 6 $MtCO_2e$ by 2035 and 10 $MtCO_2e$ by 2050[112].

[108] The Peatland Code public registry can be found here: https://mer.markit.com/br-reg/public/index.jsp?entity=project&sort=project_name&dir=ASC&start=0&acronym=PCC&limit=15&additionalCertificationId=&categoryId=100000000000001&name=&standardId=100000000000157. [last accessed 04/05/2021]

[109] BEIS (2021) UK greenhouse gas emissions statistics: planned methodology changes

[110] CCC (2019) Reducing emissions in Northern Ireland, p. 55

[111] CCC (2020) The Sixth Carbon Budget; The UK's path to Net Zero, p. 170

[112] *ibid*

In Land Use: Policies for a Net Zero UK the CCC outlined key recommendations to deliver Net Zero in the UK (table 12). Notably many of these key recommendation implementation dates have been passed.

Table 11. Key recommendations to deliver net-zero on land. Source: CCC (2020) Land use policies for a Net Zero UK, p. 15-17

Category	Recommendation	Date	Who is responsible
Upland peat restoration	Ban rotational burning on peatlands	In 2020	DEFRA and equivalent bodies in Scotland, Wales and Northern Ireland
	Mandate all peatland within a SSSI to be under restoration	Before 2023	
	Mandate water companies to restore peatland under their ownership	From 2021	
	Public money to fund the carbon and non-carbon benefits of restoration	From 2021	
	In the longer-term, use of market mechanisms to pay for the carbon benefits	By mid-2020s	
Lowland peat restoration and sustainable management	Ban peat extraction and its sale, including of imports	Before 2023	DEFRA and equivalent bodies in Scotland, Wales and Northern Ireland
	Regulate that peat soils are not left bare	From 2021	
	Require internal drainage boards to maintain optimal water table levels	Before 2023	
	Public funding for sustainable management practices, and restoration of low value land (e.g. grasslands)	From 2021	
	Research to improve verification and, in the longer-term, use of market mechanisms to pay for carbon benefits	By mid-2020s	

Enabling measures	Develop the Peatland Code to obtain UK Accreditation	From 2020	DEFRA, BEIS, HMT, HMRC, Scottish, Welsh and Northern Irish Governments, industry, universities
	Raise awareness and provide training to support adoption of sustainable management practices on peatland	From 2020	
Monitoring, reporting and verification	Introduce a strong MRV system that uses latest monitoring tools and technologies and creates a strong institutional framework to verify actions across the UK	By 2023	DEFRA and related bodies (e.g. Forestry Commission) and the equivalent bodies in Scotland, Wales and Northern Ireland

The Climate Change Act 2008 requires NI departments to prepare an Adaptation Programme. In response to this, DAERA takes the lead in the development of the Northern Ireland Climate Change Adaptation Programme 2019-2024 (NICCAP2). This is NI's second plan covering the next 5 years. It highlights the priority areas requiring urgent adaptation action across the NICS Departments. It sets the policies, strategies, actions for NICS Departments to address climate change. It also contains chapter for 'Civil Society and Local Government'.

Peatlands restoration and their ecosystem services (especially towards water detoxification) are highlighted throughout the NICCAP2[113]. The deadline for the implementation of outcome objectives relating to peatlands range from the end of 2019 to the end of 2021[114].

8 Future considerations

In 2020, a 7% decrease in global CO_2 emissions occurred (against 2019), largely due to the COVID-19 pandemic and the restriction of travel[115] (figure 6). UK emissions fell by 13% (compared with 2019)[116]. The UK Government published its 10-point plan to 'build back greener'[117] post pandemic, which included the protection and restoration of the natural environment (point 9). However, there is a lack of detail within point 9 as to how NI will directly benefit, as much of the focus is surrounding improving England's

[113] See Annex D of the NICCAP2. DAERA (2019) Northern Ireland Climate Change Adaptation Programme 2019-2024, p. 165-176

[114] *ibid*

[115] Le Quere *et al.,* (2021) Fossil CO_2 emissions in the post-COVID-19 era, Nature Climate Change, 11, p.197-199

[116] Guardian (2020) Rebound in carbon emissions expected in 2021 after fall caused by Covid [last accessed 04/05/2021]

[117] UK Government (2020) The ten point plan for a green industrial revolution: Building back better, supporting green jobs, and accelerating our path to net zero

natural environment (i.e £40m Green Recovery Challenge Fund). The DAERA minister, Edwin Poots MLA has stated that a green recovery challenge fund for 2021/22[118] is under development, but so far no further information has been published.

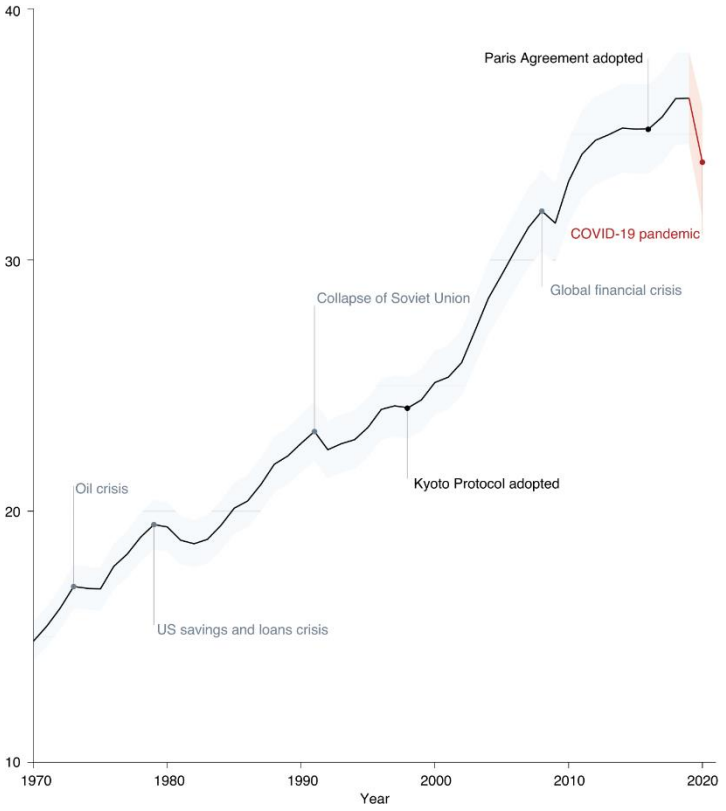

Figure 6. Annual global fossil CO_2 emissions for 1970-2019 in GtCO2 yr-1. Includes a projection (red) for 2020. Source: Le Quere et al., (2021) Fossil CO_2 emissions in the post-COVID-19 era, Nature Climate Change, 11, p.197-199

NI accounted for 4.3% of total greenhouse gas emissions in 2018 and produced the equivalent of 10.3 tonnes of CO_2 per person compared with 6.8 tonnes in the UK[119]. NI does not have specific climate change legislation, although NI specific legislation is currently being considered, and it contributes to the UK target under the Climate Act 2008. By sector agriculture provides the biggest contribution to emissions in NI with 27%, this is greater than the rest of the UK at 10%[120].

The CCC in the Sixth Carbon Budget made several policy recommendations for the agriculture and land use sectors[121];

- Post the Common Agricultural Policy, the extraction of peat and rotational burning, as well as the sale of peat for use in the horticulture sector should end;
- Restore 60% upland peat by 2035 (where this is not possible, the peat should be stabilised), and restore or stabilise the remaining area by 2045;

[118] Northern Ireland Assembly (2021) DAERA Minister's answer to written question 14907/17-22. Available at http://aims.niassembly.gov.uk/questions/search.aspx
[119] RaISe Briefing Paper (2021) Northern Ireland and Net Zero, p. 3
[120] DAERA (2020) Northern Ireland Greenhouse gas statistics 1990-2018 statistical bulletin, p. 7
[121] CCC (2020) Policies for the Sixth Carbon Budget and Net Zero, p. 149

- Rewet 20% of lowland cropland area and sustainably manage a further 18% by 2035;
- Set an obligation for water companies to restore peatland on land they own, and on owners of peatland within SSSI (and equivalents).

Advice from the CCC is not final, and exactly what policies are adopted in NI is the decision of the DAERA Minister.

NI is yet to publish a national peatland strategy. A NI peatland strategy will set the basis for peatland management and respective policy, detailing the why, what, how, who and when. Ramsar published a policy briefing on '[Peatland Strategies in Europe: Why and how to develop national strategies for peatlands]' outlining the core elements of a peatland strategy;

- **A peatland inventory** – this should include data on the type, spatial extent and thickness of peat, current state and conditions, what ecosystem services are provided, climate change projections (including greenhouse gas emissions), current management and uses, other threats to peatlands, and current protection and restoration efforts;
- **Clear and achievable targets and objectives** – these should be themed around conservation, restoration and sustainable management;
- **Include all relevant sectors** – agriculture, forestry, peat extraction, water, tourism and recreation, climate mitigation, nature conservation etc.;
- **A water management strategy** – this should take into account flood risk, drinking water, and water quality;
- **A toolbox for implementation** – the toolbox should be used to suggest measures and guidelines, as well as highlighting best practices and funding opportunities;
- **Standards for monitoring and reporting** – this enable the evaluation of current methods relevant for national reporting (e.g. greenhouse gas emissions inventories), as well as reporting successes;
- **Communication** - to enable a national strategy, communication is vital to raise awareness of the issues to the general public, stakeholders and decision makers; and
- **Cultural values** – to understand how and why people are connected to peatlands, to enable consideration of these connections during implementation

Again, the policies adopted within a peatland strategy for Northern Ireland are the decision of the DAERA minister.

Annex 1 – IUCN UK Peatland Strategy 2018-2040

Goal	Objectives	Outcomes (2018-2040)	Milestones 2020	Milestones 2030	Milestones 2040
Conservation	Long-term preservation, enhancement and sustainable management of peatlands in areas that support semi-natural mire plant communities and other semi-natural vegetation on peat soils through; • Maintaining and enhancing a suite of local, national and international level of protected areas for biodiversity alongside wider measures to ensure the favourable status of peatland habitats and species across their range • Conserving functional ecosystem units as the building blocks for habitat networks • Preventing damage from development and conflicting land management • Ensure the full long-term costs of potentially damaging activity is	95% of UK peatlands supporting semi-natural vegetation are under sustainable management for their peatland biodiversity and ecosystem function 95% of peatlands are protected under relevant local, national and/or international protected area designation types (or related designations post-Brexit) Cost savings are being made through avoiding the need for major interventions Policies are in place for peatland protection and restoration in new developments and land management change, including the prevention of intensification of	Meet the IUCN UK Peatland Programme challenge of 1m hectares of peatland in good condition, under restoration agreements and being sustainably managed Establish the current baseline and begin to define management plans	50% of the peatland resource is conserved in good condition	Target of 95% is achieved

	properly taken into account during the decision making process	artificial drainage and direct habitat destruction Environmental assessment processes are designed to assess full costs to carbon, water and biodiversity			
Restoration	Restore peatland ecosystem function and enhance biodiversity through the restoration and ongoing sustainable management of upland and lowland peatlands that no longer support semi-natural vegetation but which have; • remaining deep peat resource including mineral working, deep-drained, improved grasslands and closed canopy forestry plantations • an adjacent semi-natural peatland site that depends on the degraded area coming under restoration management Safeguard restorable peatland areas from development and land	Majority (80%) of heavily degraded peatlands in the UK are under restoration management aimed at recovering long-term security of the ecosystem Recognising that initial recovery halts losses but can begin to recover function across biodiversity and carbon sequestration; • Intervention to repair bare peat areas, former mineral workings and agricultural/afforested areas is underway to halt peat loss and re-establish peatland habitat where possible • Restoration work across the UK has	Meet the IUCN UK Peatland Programme challenge of 1m hectares of peatland in good condition, under restoration agreements and being sustainably managed	Areas capable of restoration identified and given protection in development plans	Sites identified as priorities have restoration plans agreed and suitable funding routes identified

	management activity that would undermine restoration potential Optimise UK carbon efficiency by co-ordinating forest management, renewable energy development and peatland conservation through planning to ensure positive outcomes for all	been delivered as a result of both private and public finance Land use development plans identify safeguards for peatlands, policies for forestry and renewables identify safeguards for peatlands Good practice restoration advice is available to support effective, efficient and sustainable peatland restoration			
Adaptive management	Improve farming practices on peat soil to slow the loss of soil carbon by encouraging; • Partial conversion of ploughed land to grass conversion • Other practices to reduce soil and soil carbon loss in the absence of rewetting • Water management to encourage higher water levels within the peat soils Develop and introduce wetland agriculture systems to the UK;	The impact of greenhouse gas emissions from agricultural use of peat is reduced through a shift to wetter farming The distribution and extent of agricultural peat soils across the UK is maintained through the introduction of new soil management regimes and cropping systems	Vision agreed for agricultural soils	Early opportunities are being delivered for agricultural peat soils to bring them under sustainable management regimes	Vision for agricultural soils is delivered

	• Trial new systems for and new ways of working that can reduce the carbon impact of agricultural practices on peat soils. This will include the trial and development of novel crops • Look to new markets for products from sustainably managed peatlands and develop alternative products where the use of peatland is unsustainable. In doing this, ensure that the burden of any impacts is not exported to other countries			
Sustainable management	Sustainable management across UK peatlands can be achieved through; • Demonstrating and communicating the benefits of healthy peatland landscapes and peatland restoration, and highlight the win-wins for wider society and specific land use activities	Sustainable management practices adopted on 80% of UK peatlands Healthy peatlands are delivering benefits for land managers and rural economies. Land managers are recognised for the wider services the healthy peatlands they manage deliver for society	Peatland carbon is incorporated into UK Greenhouse Gases inventory reporting and peatland management forms part of mitigation plans	All peatlands under sustainable management, as indicted by the Committee on Climate Change (2017)

	• Involving local communities at an early stage and support communities in overcoming any dependencies on unsustainable peatland use Developing economically viable systems for supporting peatland management; ○ Providing support for land managers who manage peatland sustainably, ensuring the right level of public funding to overcome any market failures ○ Avoiding public money being directed into fiscal regimes that can result in peatland damage	Local communities are engaged at the earliest stage. Support is provided to help them to overcome their opportunity costs and dependence on unsustainable peatland use			
Co-ordinate	Establish and maintain a framework to ensure funding and policy support for; • Capital costs of restoration and ongoing management	Healthy peatlands have measurable ecosystem services value to society Peatlands and the services they provide have a measureable	Funding plan in place to resource the UK Peatland Strategy, comprised of public environmental	Review public and private funding measures and address any shortfalls	Funding support is widely adopted across public and private sectors and is secured through a range of long-term programmes

	• Ongoing research and monitoring • Maintaining existing landscape-scale peatland partnerships, specifically as peatland management and advisory groups or as part of wider landscape projects • Communications work to boost peatland support with the public • Development of alternative products e.g. for use in horticulture, paludiculture crops • Applied research and monitoring to generate the evidence needed for delivery of funding support e.g. develop natural capital values for peatlands to support a natural capital based approach to management and restoration	economic value that is recognised through funding support for their conservation and management. This will include improved greenhouse gas assessments and formal accounting methodologies Public funding is secured to support restoration in return for recovery of peatland benefits to society. This is delivered through national peatland action programmes, regional peatland partnerships, environmental bodies and agri-environment funding Government recognised carbon market standards for peatland restoration are adopted in private sector Innovative funding mechanisms, which deliver private funding to support the delivery of capital costs for peatland restoration, are established	funding, public benefit payments and private funding

Communicate	Communication instils public support for peatland conservation, restoration and sustainable management as delivered by accompanying goals; • Provide printed and digital resources to enable understanding of peatlands • Share peatland stories with the media • Showcase peatland restoration case studies • Disseminate key messages to stakeholders • Present peatland science in an accessible format	Peatlands are recognised for the benefits they provide and society is aware of both the benefits of healthy peatlands and impact of degradation	Increased peatland coverage in the media, which supports the goals of this strategy (demonstrated through an impact survey)	Public attitudes survey demonstrates widespread knowledge of peatlands and support for public spending	With a large proportion of the UK's peatlands in good condition or under conservation management, communications work is focused on the benefits these habitats are delivering and the need to maintain conservation of these areas