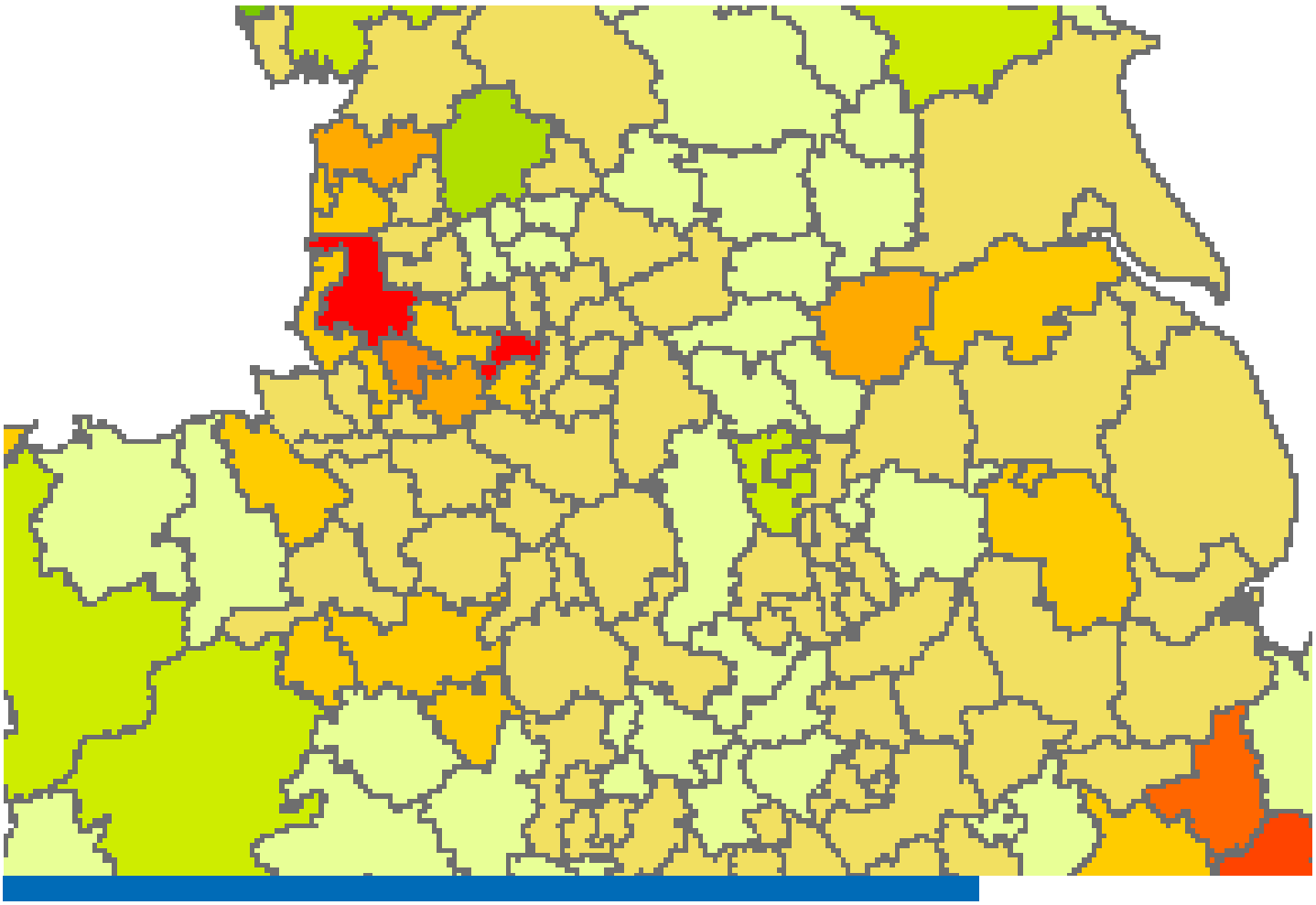

National Atmospheric Emissions Inventory

Mapping Carbon Emissions & Removals for the Land Use, Land-Use Change & Forestry Sector

Report based on the 1990-2018 Inventory

Prepared by the UK Centre for Ecology & Hydrology for the Department for Business, Energy & Industrial Strategy.

Department for Business, Energy & Industrial Strategy

RICARDO

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28th May 2020

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1 Land Use, Land-Use Change and Forestry in the National Inventory

The Department for Business, Energy and Industrial Strategy (BEIS) takes the lead in the UK in preparing the annual Inventory of Greenhouse Gas Emissions for the United Nations Framework Convention on Climate Change (UNFCCC). BEIS contract Ricardo Energy & Environment (REE) to compile the overall greenhouse gas emissions inventory and they in turn subcontract the UK Centre for Ecology and Hydrology (UKCEH) and Forest Research (FR) to prepare the data relating to Land Use, Land-Use Change and Forestry (LULUCF) in the UK.

This report is prepared in order to describe the method used to spatially disaggregate the emissions and removals in the LULUCF sector to enable the compilation of LULUCF estimates for Local Authorities as part of BEIS's assistance to Local Authorities in tracking progress on decarbonisation.

The LULUCF data reported to the annual inventory is prepared in accordance with the reporting requirements of the UNFCCC. In addition, the UK is required to provide reports to both the EU and the UNFCCC on progress towards its Kyoto Protocol (KP) target following KP reporting requirements. These are substantially different in coverage and approach. The data provided in this report are taken from the UNFCCC reporting data set and are consistent with current UK Carbon Budgets approaches.

UKCEH prepares LULUCF estimates annually, following both UNFCCC and KP approaches for inclusion in the UK GHG Inventory. These estimates are made using dynamic models of changes in stored carbon, driven by land use change data. For forestry, the CARBINE model (owned and run by FR) deals with plant carbon, dead organic matter, soil and harvested wood products and is driven by the area of land newly afforested each year, management practices and harvesting. Changes in soil carbon are driven by estimated time series of land use transitions between grassland, cropland, forest land and settlement land uses. These models, and those for other LULUCF activities, are run for each of the four devolved administrative areas of the UK. Until the 1990-2004 inventory (submitted in 2006) no data were reported in map format at a scale below the devolved administrations (England, Scotland, Wales and Northern Ireland); here we report results from methods to provide estimates of LULUCF emissions and removals at the scale of local authority (LA) within the UK for the 2018 inventory year (submitted in 2020).

The LULUCF Sector differs from other sectors in the Greenhouse Gas Inventory in that it contains both sources and sinks of greenhouse gases. The sources, or emissions *to the atmosphere*, are given as positive values; the sinks, or removals *from the atmosphere*, are given as negative values.

1.1 Categories

The IPCC Guidelines for National Greenhouse for National Greenhouse Gas Inventories (IPCC 2006) describes a uniform structure for reporting emissions and removals of greenhouse gases. This format for reporting can be seen as "land based"; all land in the country must be identified as having remained in one of six classes since a previous survey, or as having changed to a different (identified) class in that period. The six land classes are A: Forest Land, B: Cropland, C: Grassland, D: Wetlands, E: Settlements and F: Other land. There is a seventh category for harvested wood products: Category G.

The IPCC (2006) guidelines for LULUCF accommodate differences in national land-use classification systems. In current UK reporting, the Wetlands category only includes peat workings and inland waters. Emissions from peat extraction sites have been allocated to their local authorities in the UK. Bogs, marshes and fens are assumed to be used for grazing and are included in the Grassland category. Naturally occurring emissions and removals from pristine areas of bog, marsh and fen are not currently included in LULUCF reporting. Emissions of CO_2 from drained organic soils under Cropland and improved Grassland are reported in those respective categories. Emissions from drained organic soils under semi-natural Grassland are not currently captured in the LULUCF inventory, but these will be addressed when the results of a recently published BEIS-funded research project (Evans *et al*., 2017) on the implementation of the IPCC Wetlands Supplement Guidance for Peatlands (IPCC, 2014) is implemented into the LULUCF inventory. The Other land category is predominantly made up of bare rock and scree and no emissions or removals are reported. In addition, it is assumed that there are very few, if any, transitions of land to a type that is classified as 'Other'.

The UK land-use change matrix can be simplified to that shown in Figure 1, including only Forest Land (A), Cropland (B), Grassland (C) and Settlements (E) (shown clockwise from top left). For each land use and land-use transition, the change in stocks of carbon in living biomass (above and below ground), dead biomass and

soil organic matter should be reported. In Figure 1, each arrow represents the possible change for an area of land between two time points showing the corresponding category designation; '1' refers to land that has not changed use (e.g. 4A1 is for Forest Land remaining Forest Land) , '2' refers to land that has undergone change (e.g. 4A2.1 is for Cropland converted to Forest Land). The very small areas of conversion between Wetland and Grassland as a result of peat extraction activity and site restoration are not shown on this diagram.

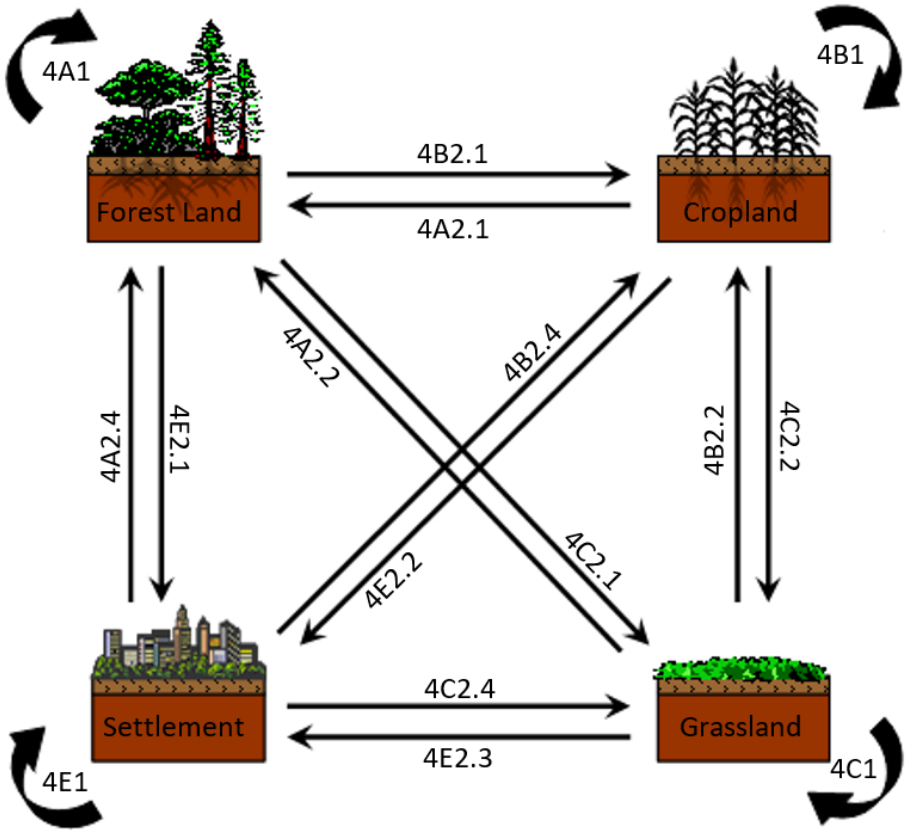

Figure 1: UK Sector 4 land-use transitions showing categories for carbon stock change. See text for details.

Different activities are associated with each land use or land-use change. For example, 'afforestation' refers to all land-use change *to* Forest Land, 'drainage' activity can relate to Forest Land, Cropland and Grassland and 'peat extraction' affects Wetlands remaining Wetlands. However, transitions *to* or *from* Wetlands are very small and therefore this category is not shown in Figure 1. The change in carbon stocks of living biomass, dead biomass and soil organic matter must be reported for each activity together with other relevant non-carbon changes.

Further subdivision of the classes by ecosystem, administrative region or time of occurrence of change is also encouraged in the IPCC Good Practice Guidance. For the UK, the data are currently subdivided into England, Scotland, Wales and Northern Ireland where possible. Subdivision into smaller units, such as 20 km × 20 km regions, is appropriate for modelling purposes and the development of estimates at local authority scale as described in this report.

1.2 Activities

The activities reported within LULUCF are listed in Table 1. The main category designations are listed with the activity description and the UK total emissions/removals (Gg CO_2) for 2018 as reported in the 1990-2018 Inventory (excluding emissions from the UK's Overseas Territories and Crown Dependencies). In this year's LA report, the units have been changed from Gg of carbon to Gg of carbon dioxide (CO_2) for consistency with the National Inventory Report. The activities are sorted in order of magnitude and divided into five groups; afforestation, emissions from soils due to land-use change, emissions from soils due to drainage, minor emissions and categories assumed to have zero emissions/removals for the UK. Full details are given in the National Inventory Report (Brown et al, 2020).

Table 1: The UK CO_2 emissions and removals in Sector 4 (Land Use, Land-Use change and Forestry) for 2018 sorted in order of magnitude.

Category	Activity	2018 UK total Gg CO_2 emission (+) or removal (-)	Group
4A	Land converted to Forest land and land remaining Forest Land (not including emissions from wildfires)	-18,360.22	Forest Land
4C	Land converted to Grassland and land remaining Grassland (change in soil carbon not including losses from drainage of organic soils)	-10,201.52	Emissions from soils due to land-use change
4B	Land converted to Cropland and land remaining Cropland (change in soil carbon not including losses from drainage of organic soils)	10,010.96	Emissions from soils due to land-use change
4E	Land converted to Settlement and land remaining Settlement (change in soil carbon)	6,061.81	Emissions from soils due to land-use change
4G*	Harvested Wood Products	-2,329.82	NA
4B1	Cropland remaining Cropland (drainage of organic soils)	1,701.88	Emissions from soils due to drainage
4C2	Forest Land converted to Grassland (deforestation to grassland – not including soil changes)	532.72	Minor emissions
4C2	Non-Forest land converted to Grassland (change in non-forest living biomass)	460.80	Minor emissions
4E2	Forest Land converted to Settlement (deforestation to settlement – not including soil changes)	425.30	Minor emissions
4B1	Cropland remaining Cropland (cropland soil management practices)	-379.66	Minor emissions
4D1	Wetlands remaining Wetlands (peat extraction)	334.99	Minor emissions
4B2	Non-Forest land converted to Cropland (change in non-forest living biomass)	-288.57	Minor emissions
4C1	Grassland remaining Grassland (drainage of organic soils)	176.80	Emissions from soils due to drainage
4E2	Non-Forest land converted to Settlements (change in non-forest living biomass)	67.75	Minor emissions
4C1	Grassland remaining Grassland (grassland biomass management practices)	54.88	Minor emissions
4A1	Forest Wildfires	29.65	Minor emissions
4B1	Cropland remaining Cropland (cropland biomass management practices)	2.31	Minor emissions
4B2+	Forest Land converted to Cropland (deforestation to crop – not including soil changes)	0.00	Minor emissions

* Sector 4G (Harvested Wood Products) is not included in the LA estimates because of insufficient data for distributing the emissions and removals.

Each of the three groups of activities are described below. Emissions and removals from the LULUCF Sector are predominantly of CO_2. Emissions of other greenhouse gases are produced by biomass burning during wildfires or the conversion of Forest Land to Cropland, Grassland or Settlements (CH_4, N_2O, NO_x and CO). Direct and indirect emissions of N_2O are also produced from nitrogen fertilisation of new forests and soil mineralisation following land-use change. Estimates of N_2O and CH_4 emissions from these sources are included in the 2018 inventory (1.4 Gg CH_4 or 34.4 Gg CO_2e (Carbon dioxide equivalents) for methane and 4.7 Gg N_2O or 1,393.2 Gg CO_2e for nitrous oxide across the UK in 2018). Emissions of these non-CO_2 gases

from agricultural land (e.g. due to fertilisation) are reported in the Agriculture sector of the Greenhouse Gas Inventory. Only emissions and removals of CO_2 are included in this report.

2 Forest Land

For the National Inventory, the carbon uptake by forests planted in the UK is calculated by a carbon accounting model, CARBINE, as gains and losses in pools of carbon in standing trees, litter and soil in conifer and broadleaf forests and in harvested wood products. Forests accumulate carbon (by removing CO_2 from the atmosphere) in their biomass and soils as they grow, but timber harvesting and planting activities disturb this accumulation and result in loss of carbon via emissions of carbon dioxide, and other carbon-containing substances, to the atmosphere. The net carbon stock change at any one time depends on the balance between these different activities. Forestry management cycles operate over long time scales (40+ years) so the rate of carbon dioxide removal *now* is driven by the rate of forest planting in previous decades. Three types of input data are required for the model; a) areas of new forest planted in each year in the past, b) the stemwood growth rate and c) management/harvesting pattern.

The national estimates use the combined area of new private and state planting from 1920 to 2018 and estimated planting areas for pre-1920 for England, Scotland, Wales and Northern Ireland sub-divided into conifers and broadleaves. For mapping at LA scale, the results from the CARBINE model for England, Scotland, Wales and Northern Ireland were disaggregated to 20 km × 20 km grid squares across the UK using country level historic average estimates of planting data reformatted to this scale. The disaggregated data were then combined to provide estimates per local authority. This is achieved by taking the 20 km grid square data and disaggregating further to every 1 km square in the UK. Up to 400 1 km grid squares make up one cell in the 20km resolution map, however in coastal regions where cells fall in the sea the flux is apportioned to the land-based 1km data points enclosed within the 20km cell. These smaller units can then be combined according to the LA boundaries based on the SW corner of each cell (see Figure 2). This year, the LA boundaries have been updated with the latest Office for National Statistics data (ONS, 2019), which has merged some of the LAs and thus reduced the total number of districts.

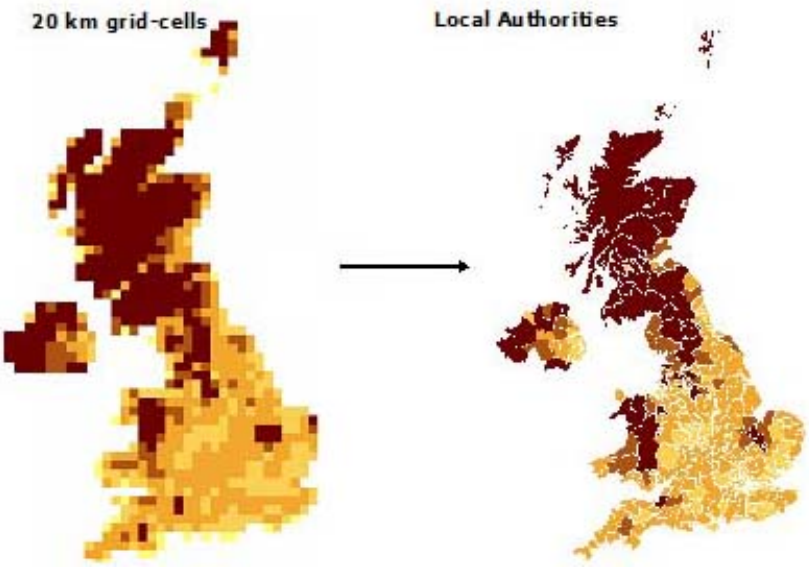

Figure 2: Model output is generated for 852 20 × 20 km squares across the UK, which is further disaggregated to 245,655 1 × 1 km land-based squares (not shown). Data are combined to provide estimates for each local authority (data for illustration only).

Figure 3 shows the distribution of carbon removals due to forest land per local authority area expressed as tonnes of carbon dioxide per square kilometre (tCO_2 per km^2). Maps of total CO_2 emissions/removals per LA can be misleading due to the wide range of areas across authorities – maps tend to be dominated by the Highland region of Scotland. The distribution of forest carbon removals is directly linked to the location of forests (Forestry Commission, 2018), for example close to half of the forest land in England is in the north, which is clearly visible from the large sink in that area.

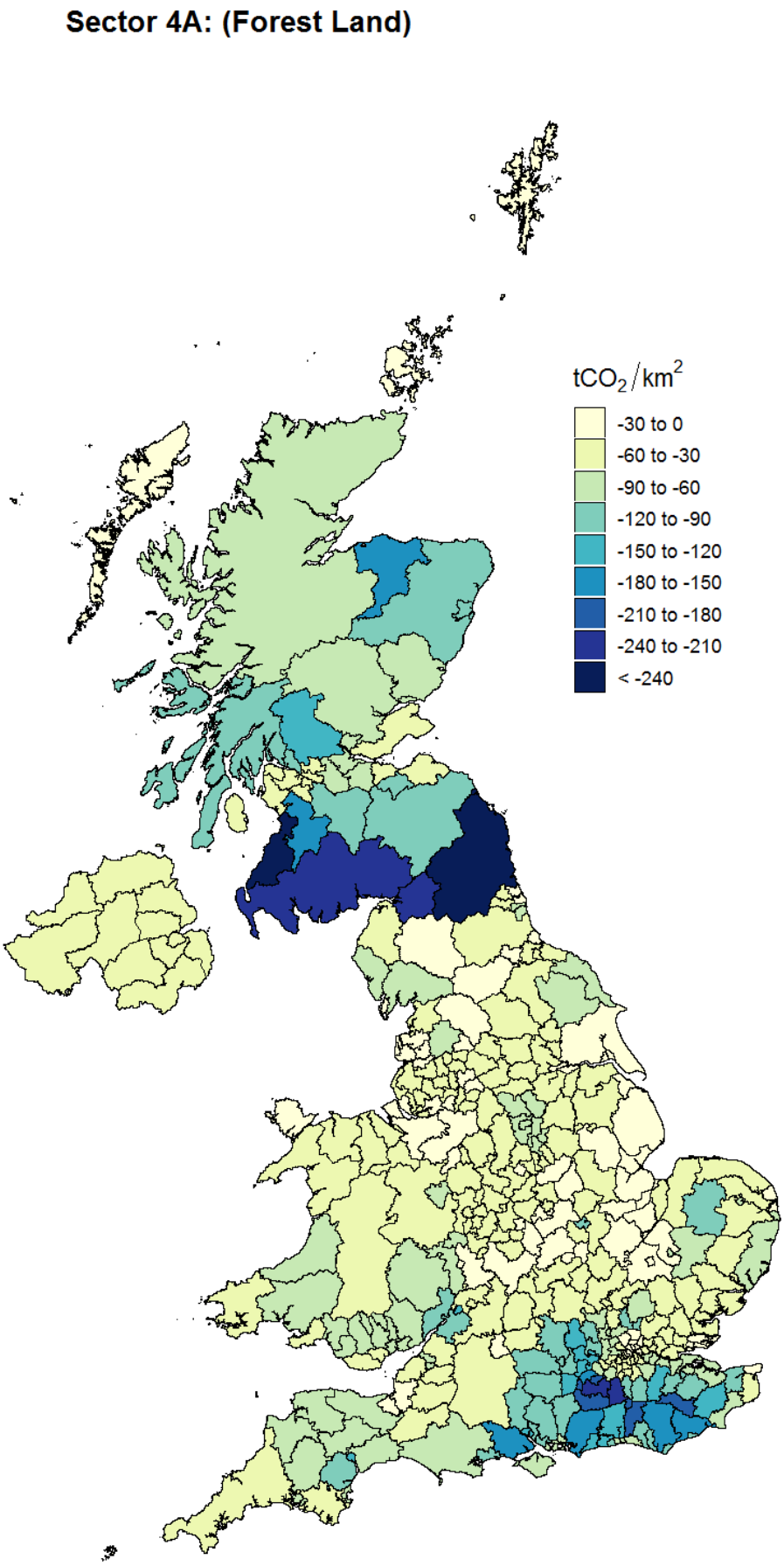

Figure 3: Distribution of forest carbon dioxide removals from the atmosphere in 2018 per local authority area expressed as tCO_2 per km^2.

3 Emissions from soils due to land-use change: cropland, grassland, settlements

Changes from one land use type to another will result in a change in soil carbon stocks over time. The change in vegetation cover and management will affect the amount of carbon that goes into the soil from biomass decomposition. This is represented by emissions or removals which continue for decades after the change in land use until equilibrium carbon stocks characteristic of the new land use are reached. Also, any initial disturbance of the soil is represented by a release carbon from soils to the atmosphere as CO_2.

For the LULUCF inventory, the method for assessing changes in soil carbon stock due to land-use change links a matrix of area changes at country level coming mainly from land surveys to a dynamic model of carbon stock change. For Great Britain, matrices from the Monitoring Landscape Change data from 1947 & 1980 (MLC, 1986) and the Countryside Surveys (CS) of 1984, 1990, 1998 and 2007 are used and the rates observed after 2007 obtained by extrapolating rates of change observed pre-2007.

In Northern Ireland, for 1990 to 1998 and 1998 to 2007, a matrix for the whole of Northern Ireland was available from the Northern Ireland Countryside Survey (Cooper, McCann and Rogers 2009). The only data available pre-1990 for Northern Ireland are land-use areas from the Agricultural Census and the Forest Service (Cruickshank and Tomlinson 2000). Matrices of land-use change were then estimated for 1970-80 and 1980-90 using area data. The basis of the method devised assumed that the relationship between the matrix of land-use transitions for 1990-1998 and the area data for 1990 is the same as the relationship between the matrix and area data for each of two earlier periods – 1970-79 and 1980-89. The matrices developed by this approach were used to extrapolate areas of land-use transition back to 1950 to match the start year in the rest of the UK.

Time series of land-use change in 20 × 20 km grid-cells (to match those used for the afforestation fluxes) have been developed using the Countryside Surveys covering periods 1984 to 1990, 1990 to 1998 and 1998 to 2007 (Mobbs and Milne 2005). The land-use change matrices for the 20 × 20 km grid-cells are scaled to match those used in estimates of emissions and removals for the devolved administration areas in the United Kingdom. These matrices are then used for each grid-cell as input to the soil carbon model. The data are then combined to give estimates per local authority (see Figure 4). The pattern of emissions and removals across the UK for each land-use type is dependent on the ratio of land-use change in each LA in relation to the total for that devolved administration (England, Scotland, Wales and Northern Ireland). For example, the majority of land-use change to both Cropland and Grassland in Scotland occurs in the south and east of the country. For Northern Ireland there is no spatial information available so the values for each LA are the same.

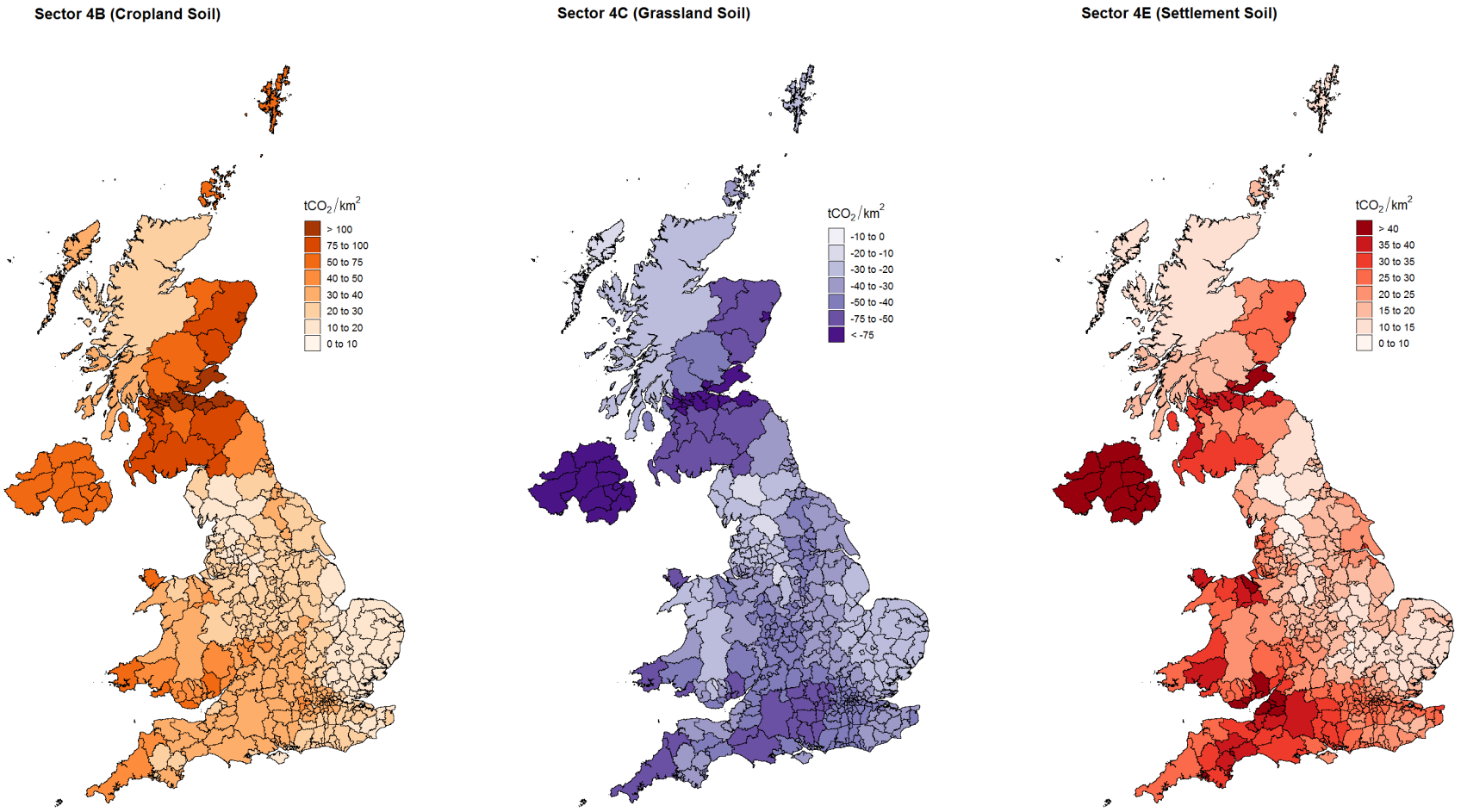

Figure 4: Carbon dioxide emissions from soil due to land-use change per local authority area (tCO_2/km^2) in 2018. This covers the conversion of all land types to (a) Cropland (b) Grassland and (c) Settlements.

4 Emissions from soils due to drainage of organic soils: cropland, grassland

Lowland wetlands were drained many decades ago for agricultural purposes and continue to lose carbon from the soil as CO_2. The method for estimating drained areas at both the UK and LA scale is to compare maps of histosol (organic soil) areas with maps of land use (See Brown et al. 2020 Annex section A3.4.6). Emissions are then calculated from the areas using a simple Tier 1 approach. Figure 5 shows the estimated distribution of emissions (tCO_2/km^2).

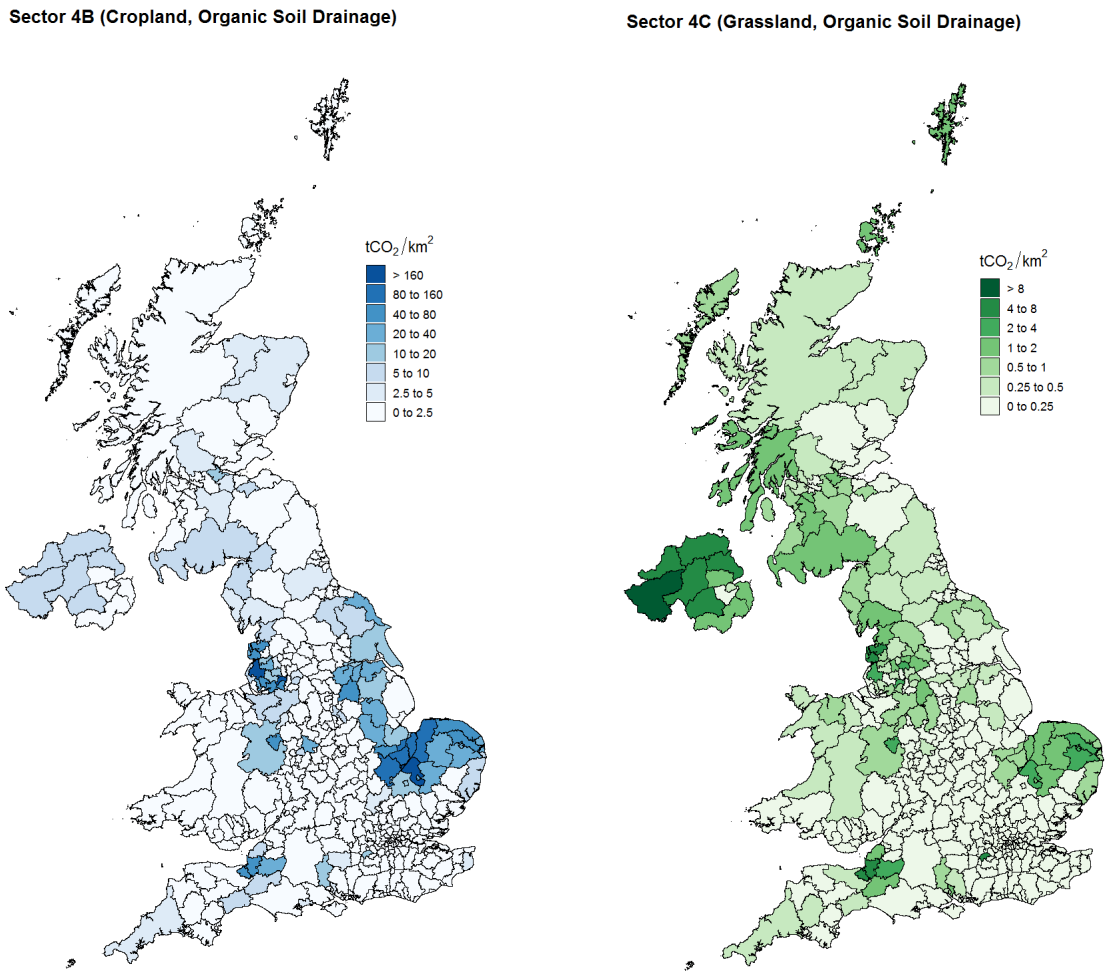

Figure 5: Carbon dioxide emissions due to drainage of organic soils under Cropland and improved Grassland per local authority area (tCO_2/km^2) in 2018.

5 Estimates of various minor emissions

5.1 Non-Forest Biomass

The different land-use types have different biomass carbon densities per area at equilibrium. Change from one land use type to another can result in an increase or decrease in biomass carbon density per area. This category describes the annual change in the carbon stock in vegetation biomass due to all land-use change to Grassland, Cropland or Settlements, excluding forests and woodland.

For the LULUCF inventory, estimates of emissions and removals for this category are made using the Countryside Survey Land-Use Change matrix approach. Changes in carbon stocks in biomass due to land-use change are based on the same area matrices used for estimating changes in carbon stocks in soils. The biomass carbon density per area for Wetlands and Settlement were assigned by expert judgement based on the work of Milne and Brown (1997). Average biomass densities per area for Cropland and Grassland used in the non-forest biomass LUC model are the same as those used in the cropland and grassland management calculations, based on a UK-relevant literature review in Moxley *et al*. (2014). Five basic land uses were assigned initial biomass carbon densities per area, then the relative occurrence of these land uses in the four countries of the UK were used to calculate mean biomass carbon densities per area for each of the IPCC types, Cropland, Grassland and Settlements. The mean biomass carbon densities per area for each land type were then weighted by the relative proportions of change occurring between land types in the same way as the calculations for changes in soil carbon densities per area. Changes between these equilibrium biomass carbon densities per area were assumed to happen in a single year. This matrix approach was extended and applied to each 20 km × 20 km grid square across the UK, and the results combined to give estimates for each local authority (see Figure 6).

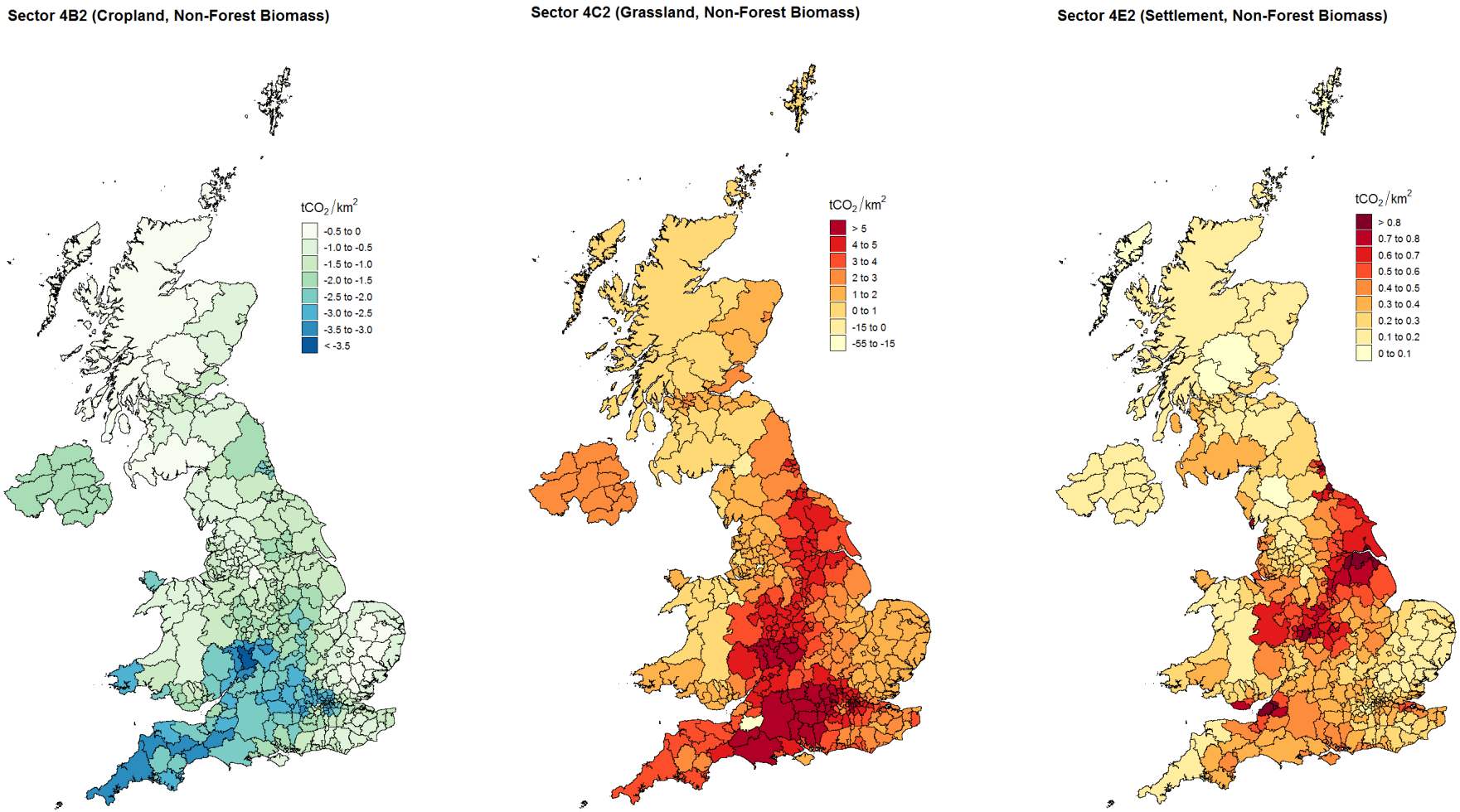

Figure 6: Changes in living biomass following land-use change from Grassland and Settlements to Cropland (4B2), from Cropland, Settlements and Wetlands to Grassland (4C2) and Cropland, Grassland and Wetlands to Settlements (4E2) in 2018, expressed as emissions or removals per local authority area (tCO_2/km^2).

5.2 Peat Extraction

Carbon emissions from peat extraction are calculated for the LULUCF inventory based on data published in the *Mineral Extraction in Great Britain Business Monitor PA1007* which gives data on volumes of peat sold, the *Directory of Mines and Quarries (DMQ)* which gives the location of peat extraction sites, and Google Earth which provides information on the area of peat extraction sites. The publication of the peat extraction data has been discontinued from 2014, so for 2015 onwards the 2005-2014 average value is used. The DMQ data give the location of origin of the peat and we have assumed that the carbon emission applies to this area (see Figure 7).

Due to rounding errors in the published figures, the sum of the extraction areas for the DAs does not exactly equal the national totals. In LAs with peat extraction, the total emissions resulting from peat extraction in each country were adjusted in proportion to the area of peat extraction per LA so that the total equals the submitted national emission. Local authorities with no peatland extraction activities have zero emissions from peat extraction. Emissions from peat extraction are reported in category 4D (Wetlands).

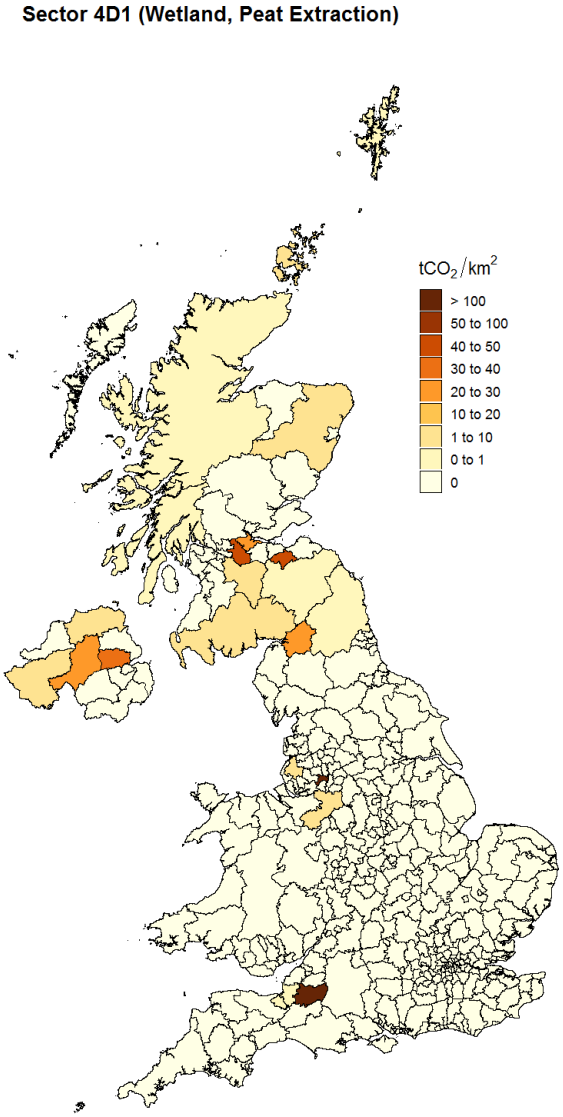

Figure 7: Carbon dioxide emissions from the extraction of peat for horticultural use per local authority area (tCO_2/km^2) in 2018. This is part of the Wetlands category.

5.3 Deforestation

Emissions due to deforestation are disaggregated into deforestation to Cropland (reported in 4B, and only occurring in England and Scotland up to 2006 and 2005 respectively), Grassland (4C) and Settlements (4E). This includes emissions from loss of living biomass and decay of dead organic matter, but excludes emissions from soils as these are presented separately, see Section 3.

The area of land deforested in each Local Authority is not currently available, so we assume that the area deforested is proportional to the total area of forest in each LA. We also assume that the relative conversion of forest to either Cropland, Grassland or Settlement is the same for each LA (see Figure 8, this does not show Deforestation to Cropland as this was zero in 2018).

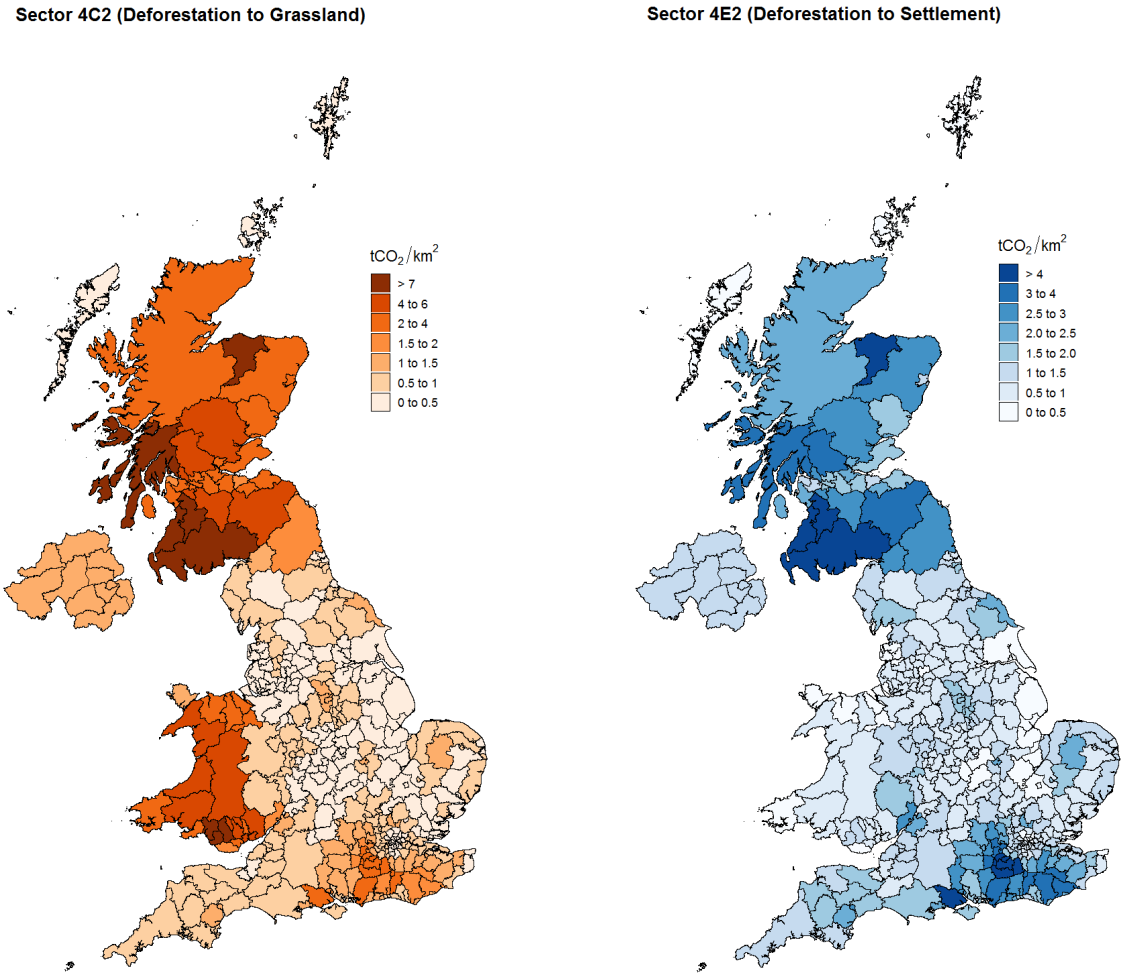

Figure 8: Emissions of carbon dioxide from deforestation to Grassland or Settlements per local authority area (tCO_2/km^2) in 2018.

5.4 Forest Wildfires

Information on areas of wildfires on forest land in Great Britain and in Northern Ireland is available from the Fire Service Incident Reporting System (IRS). This dataset is available at individual grid referenced fire level for Great Britain and as a national total for Northern Ireland. Hence in Great Britain fires can be assigned to the LA in which they occurred, and in Northern Ireland the emissions are assigned between LAs in proportion to the total area of forest land in each LA. Forest wildfires only occurred in Scotland and Northern Ireland in 2018 as shown in Figure 9.

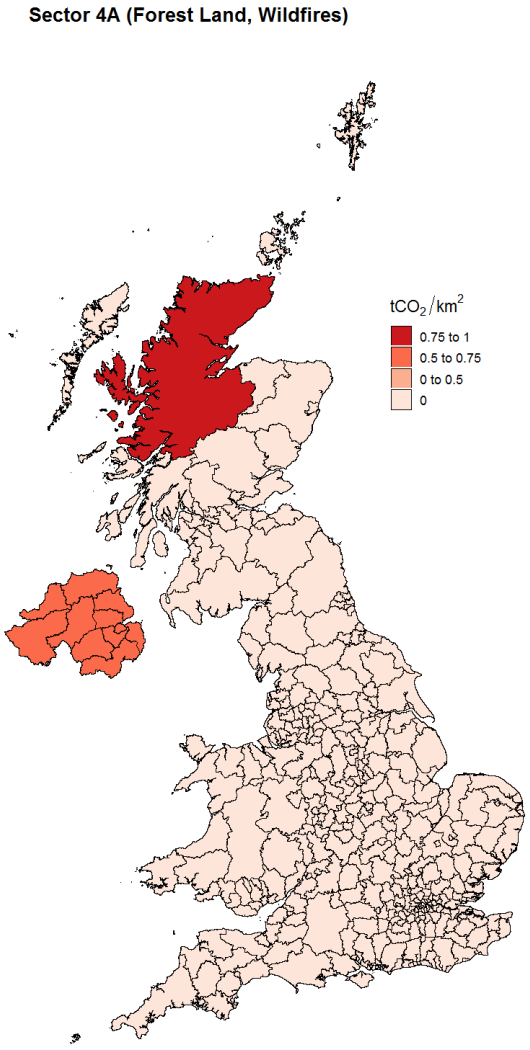

Figure 9: Emissions of carbon dioxide due to forest wildfires per local authority area (tCO_2/km^2) in 2018.

5.5 Cropland Management Soil

Cropland management activities including inputs of fertiliser, manure and crop residues have an impact on soil carbon stocks. Data on the areas under the main crop types are obtained from the annual June Agricultural Censuses carried out by each UK administration (Defra, 2018; Welsh Government, 2018; Scottish Government, 2018; DAERA, 2019). Data on the areas of Cropland receiving inputs of manure, fertiliser and crop residues are obtained from the annual British Survey of Fertiliser Practice (Defra, 2019 and previous editions). The emissions were disaggregated to the LA level using the same methodology as for Cropland soil emissions. The resulting assignment by LA is shown in Figure 10.

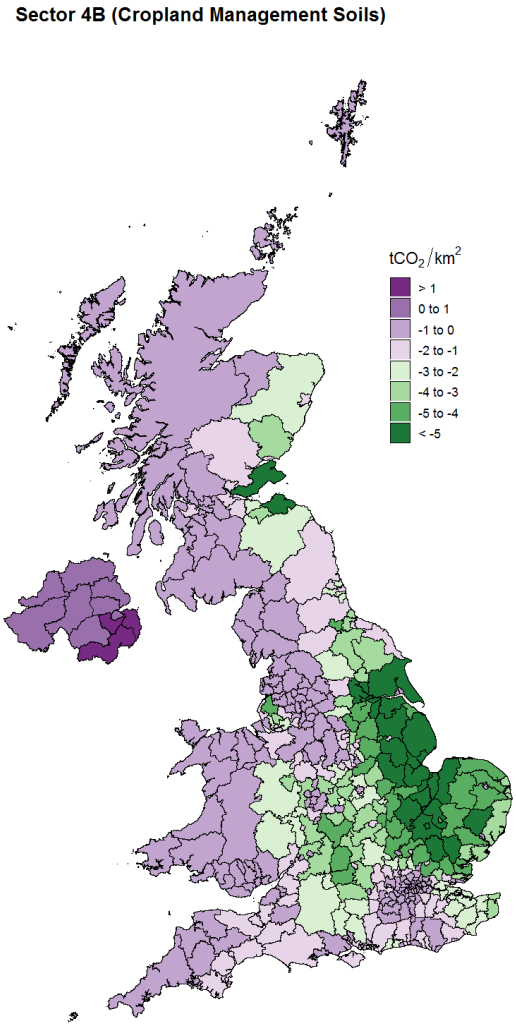

Figure 10: Emissions / removals of carbon dioxide from Cropland Management soil activities per local authority area (tCO_2/km^2) in 2018.

5.6 Cropland and Grassland Management Biomass

Changes in biomass carbon stocks arising from Cropland and Grassland management activities are reported in the inventory. These include change between annual crops, orchards, short rotation coppice, set aside and fallow for Cropland and change between shrubby and non-shrubby grassland types and hedge creation and removal for Grassland. Data on the areas under the main crop types are obtained from the annual June Agricultural Censuses carried out by each UK administration (Defra, 2018; Welsh Government, 2018; Scottish Government, 2018; DAERA, 2019). Data on areas of grassland types are derived from the Countryside Surveys of 1990, 1998 and 2007. Information on emission factors were derived from a literature review described in Moxley *et al*. (2014). The emissions and removals were disaggregated to the LA level using the same methodology as for Cropland and Grassland non-forest biomass emissions. The resulting assignment by LA is shown in Figure 11.

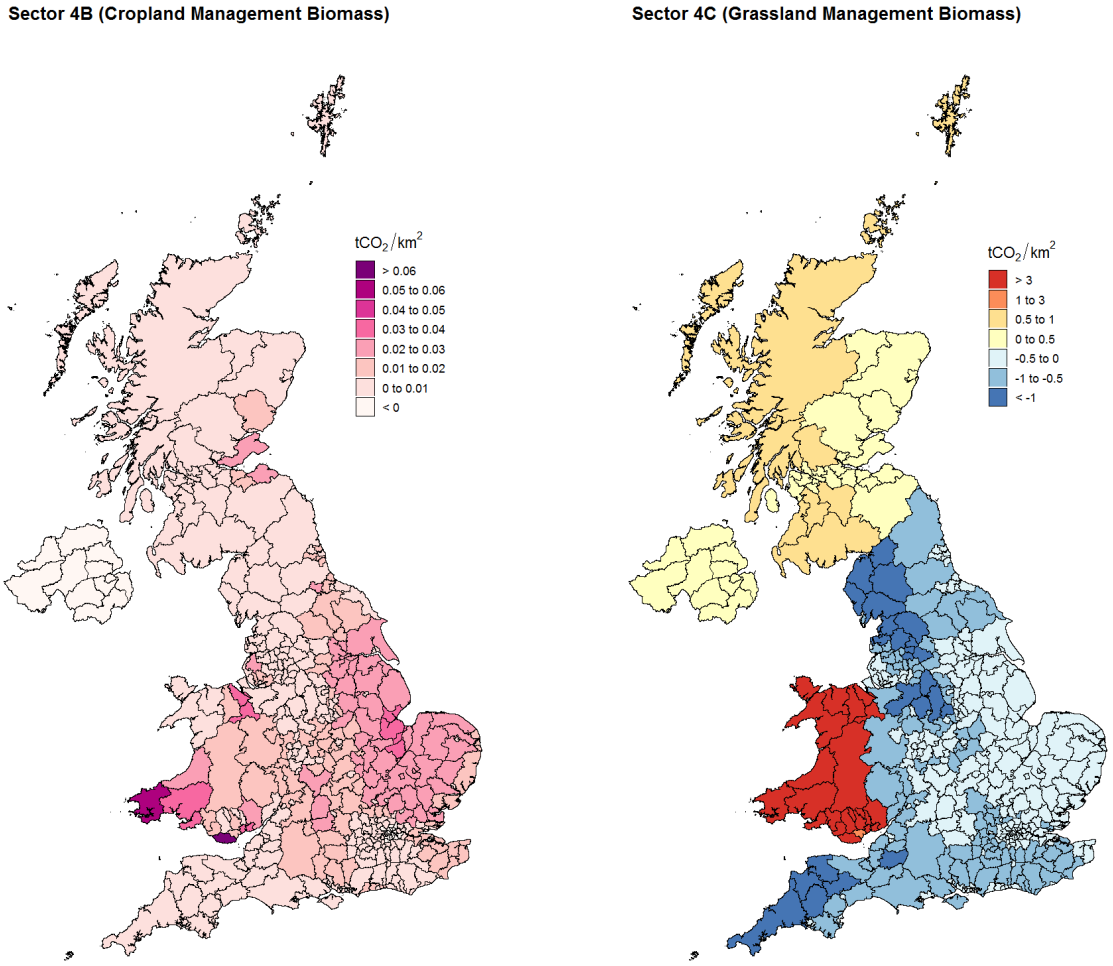

Figure 11: Emissions / removals of carbon dioxide from Cropland and Grassland Management biomass activities per local authority area (tCO_2/km^2) in 2018.

6 LULUCF Totals

The total emissions of carbon dioxide for the UK land use, land-use change and forestry sector (excluding harvested wood products which cannot be mapped) are shown in Figure 12.

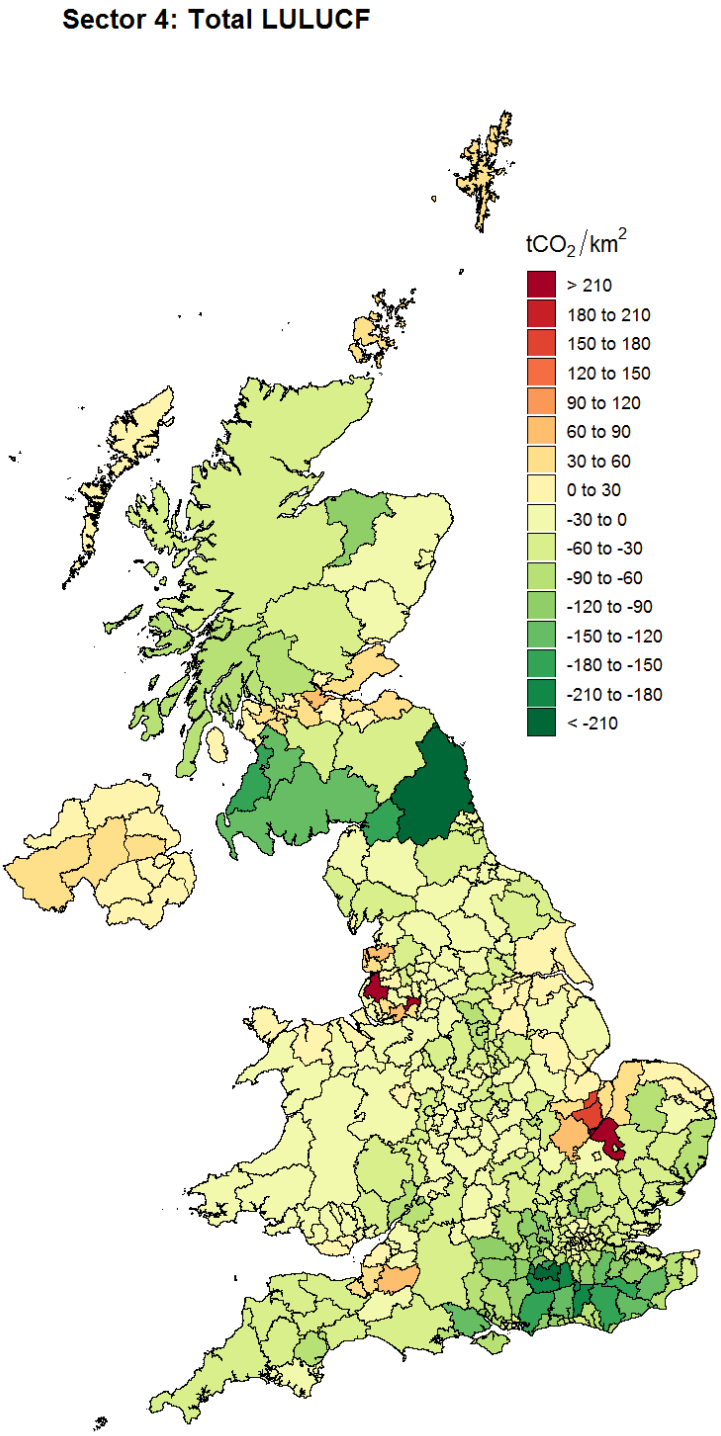

Figure 12: Emissions or removals of carbon dioxide from land use, land-use change and forestry per local authority area (tCO_2/km^2) in 2018.

7 Uncertainties

The uncertainties in calculating the LULUCF inventory are described in an annex of the National Inventory Report (Brown et al, 2020) and are in the range of 35-50% for CO_2 in 2018. Additional uncertainty is associated with disaggregating the dataset to LA scale. A full uncertainty analysis of this procedure has not been carried out, however, it is estimated that the uncertainty in the disaggregation process is in the range of 20-30 %.There is low uncertainty in the LA mapping of carbon emissions associated with wildfire occurrence and peatland extraction due to fine-scale spatial input data. Moderate uncertainty in the disaggregation process is attributed to emissions from forest land, soils due the land-use change, soils due to drainage, and the minor categories where similar input scales and methodology were employed. There is higher uncertainty in the LA mapping of deforestation due to a lack of deforestation data below DA level; hence, a proxy using forested area and total deforestation is applied.

Table 2: Summary of source data and estimated uncertainty associated with the disaggregation of emissions to the local authority level.

Category	Source data used for disaggregation	Uncertainty
Forest Land	UK forestry and planting data from the National Inventory of Woodland and Trees	Moderate
Emissions from soils due to land-use change - Cropland, Grassland, Settlements	Extrapolation from Countryside Surveys	Moderate
Emissions from soils due to drainage of organic soils – Cropland, Grassland	Histosol (organic soil) areas, land-use maps	Moderate/Low
Minor estimates:		
Non-Forest Biomass	Countryside Surveys	Moderate
Peat Extraction	BGS BritPits database co-ordinates	Low
Deforestation	As for Forest Land	High
Wildfires	Fire and rescue service Incident Recording System	Low
Cropland Management Soil	Countryside Surveys	Moderate
Cropland and Grassland Management Biomass	Countryside Surveys	Moderate

8 Recalculations

The National Inventory is often updated to include improved, or new, datasets and modelling techniques. In the 2018 inventory there were a number of changes and improvements (Table 3). More detailed descriptions of the changes can be found in the UK National Inventory Report (Brown et al, 2020) .

Table 3: Details of all changes between the 2017 and 2018 LULUCF inventories.

Description of Change	Reason for Change	Categories Affected	1990-2017 Inventory 2017 UK Value ($GgCO_2$)	1990-2018 Inventory 2017 UK Value ($GgCO_2$)	1990-2018 Inventory 2018 UK Value ($GgCO_2$)
Reconciliation of harvest volume and forest age data from the forest inventories. Improvements to CARBINE model (correction of potential double-counting of litter and deadwood; correction of deadwood on deforested land not being reported; improvement to the foliage decay function; improvement to the soil model)	Error identification and correction.	4A (not including wildfires)	-18203.85	-18453.78	-18360.22
Correction of cropland areas. Change in soil carbon density for crop management.	Correction of a transposition error from the agricultural census data for England for the areas of potatoes and sugarbeet in 2017, and correction of an area calculation for oats. A change in the equilibrium soil carbon density as recommended in the 2019 in-country review.	4B1 Cropland remaining cropland (cropland management - soil)	-637.57	-368.31	-379.66
		4B1 Cropland remaining cropland (cropland	29.62	20.17	2.31

Description of Change	Reason for Change	Categories Affected	1990-2017 Inventory 2017 UK Value ($GgCO_2$)	1990-2018 Inventory 2017 UK Value ($GgCO_2$)	1990-2018 Inventory 2018 UK Value ($GgCO_2$)
		management biomass)			
Revision of deforestation activity data	Inventory improvement due to new activity data. QA Improvement to ensure the same precision as reprocessed Countryside Survey data.	4C2 deforestation to grass (not including soil)	517.08	527.91	532.72
		4E2 deforestation to settlement (not including soil)	303.28	421.24	425.30
		4C soil	-10,101.94	-10,107.77	-10,201.52
		4E soil	6,055.05	6,071.39	6,061.81
		LULUCF Total[1]	**-11,323.44**	**-11,534.54**	**-11,699.94**

[1] This is the total for all categories (both recalculated and unchanged).

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