UK Rural Land Use Archetypes

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1. Introduction

The Committee on Climate Change (CCC) want to identify and quantify the impact of plausible land use change/management transitions in rural landscapes on greenhouse gas emissions out to 2035 and 2050. This report documents the initial development of a set of archetypes that are representative of current UK rural land-use and land-management. Archetypes represent a typical example of something, in this case management at a farm or landscape level.

The archetypes are intended to represent key differences across a range of parameters, including:

- Geography (including soil type, elevation, incline and climate)
- Extensive and intensive agriculture
- Land-use (e.g. arable farming, grazing land, woodland etc) and land-management (e.g. mixed farming, intensive farming etc).
- Spatial scale (landscape-scale and farm-scale)
- Devolved Administrations (DAs) – at least two shortlisted archetypes are relevant for each DA

There are similarities in approach with the Landscape Character Assessment Areas/Types that have been developed for England, Scotland, Wales and Northern Ireland, both at national and local council levels[1] and used for a range of purposes including development planning[2], monitoring landscape change[3] and understanding local identities[4]. However the CCC archetypes are not intended to cover the entire UK land area, and are primarily focussed on land use and land management in rural settings.

An initial long-list of twenty archetypes was first developed and then refined to a shortlist of twelve. Baseline descriptions of each of the archetypes are provided, including the land area covered, source of the data for mapping the archetypes locations, and how the land is used and managed in the archetype. In addition, baseline estimates of Land Use, Land Use Change and Forestry (LULUCF) and Agriculture sector emissions from the national greenhouse gas inventory are provided for each shortlisted archetype. Future work will quantify the impact of plausible land use transitions applied to these archetypes, including changes in land use and management to reduce GHG emissions, increase carbon

[1] https://www.landscapeinstitute.org/news/the-landscape-character-database-for-the-uk-and-ireland-is-now-available/

[2] https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/landscape-character-assessment-scotland

[3] https://www.gov.uk/guidance/landscape-and-seascape-character-assessments#what-lcas-are-used-for

[4] https://www.daera-ni.gov.uk/articles/landscape-character-northern-ireland

sequestration, improve climate resilience, increase biodiversity and maintain food production.

Provided alongside this report are files with the mapped locations of the shortlisted archetypes.

2. Literature Review – land use archetypes

Archetypes are used as a methodological approach to understand recurrent patterns in variables and processes that shape social-ecological systems (Sietz et al., 2019; Oberlack et al., 2019). In particular, archetype analysis aims to identify generalisable patterns while keeping the richness in detail that more localised case studies can provide (Oberlack et al., 2019). Archetypes can be used to identify patterns, as a starting point for developing more detailed typologies of cases and for scenario development (Oberlack et al., 2019). It has also been suggested archetypes can be used to identify regions where similar policy tools could be applied (Levers et al., 2018), to communicate between scientists and policymakers and identify policy areas to prioritise (van der Zanden et al., 2016), and to identify major land pressures and identify alternative land-use strategies (Václavík et al., 2013).

Archetypes can be developed using quantitative, qualitative or mixed method approaches (Oberlack et al., 2019). Quantitative methods include data-driven approaches such as machine learning algorithms, cluster analysis, spatial statistics and meta-analyses, while qualitative methods include expert assessment and qualitative classification (Sietz et al., 2019). Archetypes have been applied across a range of spatial scales, from local to global, within sustainability research (Oberlack et al., 2019). Archetype analysis has been used to look at a range of topics including interactions between land, biodiversity, food and climate (Seitz and Neudert 2022), land systems, water systems, governance and societal development, global change and social-ecological systems (Oberlack et al., 2019).

Considering land use in particular, studies have considered this on a range of spatial scales and using both quantitative and qualitative approaches. At the global scale, Václavík et al. (2013) used a machine-learning algorithm to develop land system archetypes based on indicators of land use intensity and environmental and socio-economic conditions. Beckmann et al. (2022) used a similar data-driven approach to develop agri-environmental archetypes of Europe (as well as smaller subnational regions) by clustering on topographical, soil characteristic and bioclimatic data. Levers et al. (2018) used a data-driven machine learning approach

with the outputs then reviewed and refined by experts in a workshop to develop archetypes of land use and change trajectories in Europe. Also considering Europe, van der Zanden et al. (2016) developed archetypes of agricultural landscapes based on land cover, landscape structure and land management datasets, comparing the results of an expert-based top-down approach selecting variable thresholds and creating a decision tree to characterise locations, with a bottom-up data-driven self-organising maps approach. The results of these two approaches were generally very similar, but with some of the more specific expert-based categories aggregated in the data-driven approach. Goodwin et al. (2022) focussed just on Great Britain and developed landscape and farmland archetypes at three scales using a data-driven machine learning approach to cluster grid cell locations into archetypes: Tier 1 landscape archetypes included differences in land cover, land features and population; Tier 2 farmed landscape archetypes included elements of more importance in farming which may be modifiable by land managers over long time periods; and Tier 3 farm management archetypes included agro-ecological and socioeconomic differences which are under land managers' control.

For the purposes of this work, the archetypes produced by Goodwin et al. (2022) were deemed to be most appropriate to consider further. These archetypes focus specifically on Great Britain and are able to provide more detailed and country-specific information than the Europe-wide studies. Therefore these archetypes were used as a key dataset in producing the list of archetypes for the CCC, as described in the Methodology.

3. Methodology

3.1 Archetypes longlist and datasets used

First a longlist of 20 archetypes covering Great Britain (GB) and Northern Ireland (NI) was produced. The approaches for developing archetypes for GB and NI differ due to the data available for each, as described in the following sections.

Great Britain

The archetypes for Great Britain are primarily based on the Tier 1 Landscape Archetypes and Tier 2 Farmed Landscape Archetypes developed by Goodwin et al. (2022, Figure 1) and available online (Goodwin et al. 2022b). These were produced using a machine learning approach to cluster 1km grid cells into similar groupings based on a range of datasets including land cover, geo-physical properties and socio-economic factors. The Tier 1 landscape archetypes included differences in land cover, land features and population, while the Tier 2 farmed landscape archetypes included variables more specifically relevant to farming and managing

farmland, such as soil moisture, slope of the land, and locations of designated protected areas.

In selecting archetypes for the CCC longlist, we selected those that cover large proportions of the GB land area and represent the range of land uses and land management present across GB. We included both archetypes defined across well-defined landscape areas and across more scattered locations.

We also use the Greenhouse Gas Inventory peat condition maps (Clilverd et al. 2023; Figure 2) to define organic soils archetypes for GB, as management options and opportunities for future transitions are likely to differ on organic soils compared to mineral soils.

The 2021 Land Cover map (Marston et al., 2022; Figure 3) was also used to assess land cover types within each archetype. The data used is the dominant land cover at the 1km scale.

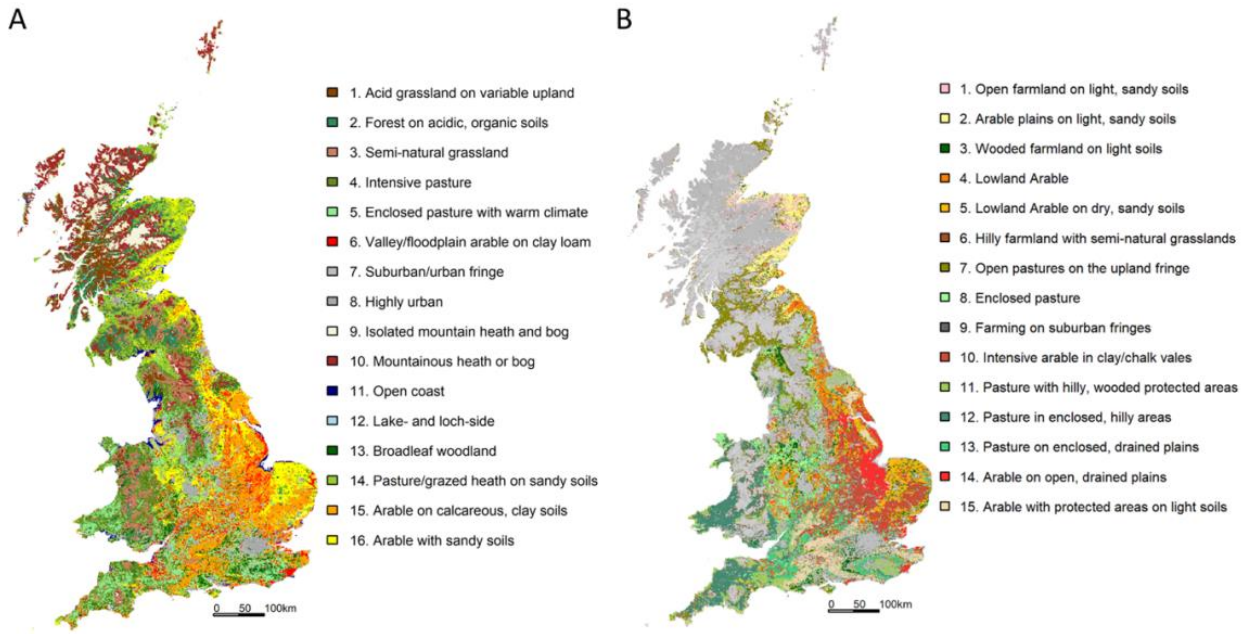

Figure 1 Tier 1 Landscape archetypes and Tier 2 farmed landscape archetypes for GB. Figure from Goodwin et al. (2022)

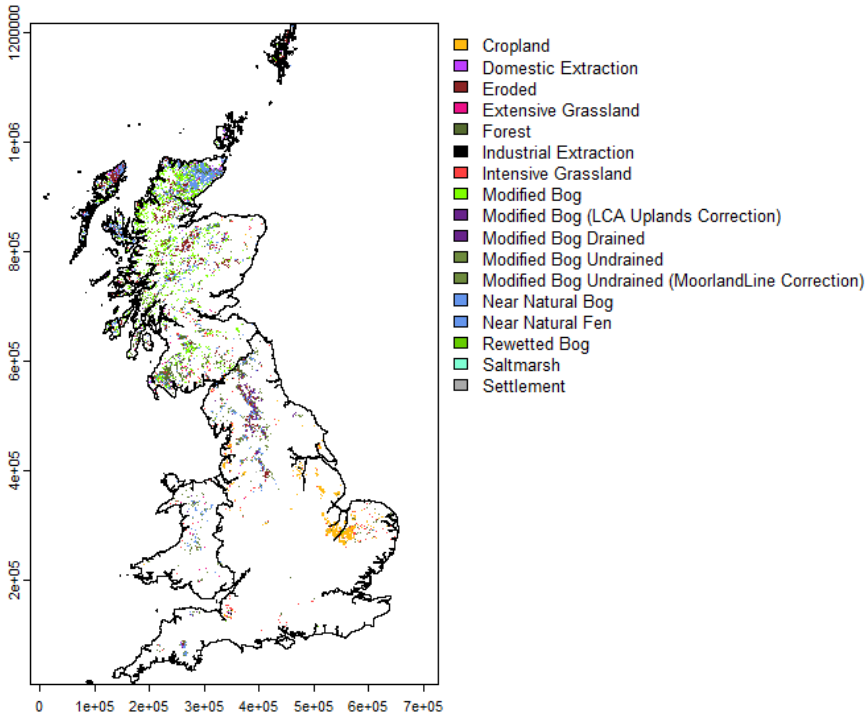

Figure 2 Peatland condition in GB, data from Clilverd et al. (2023)

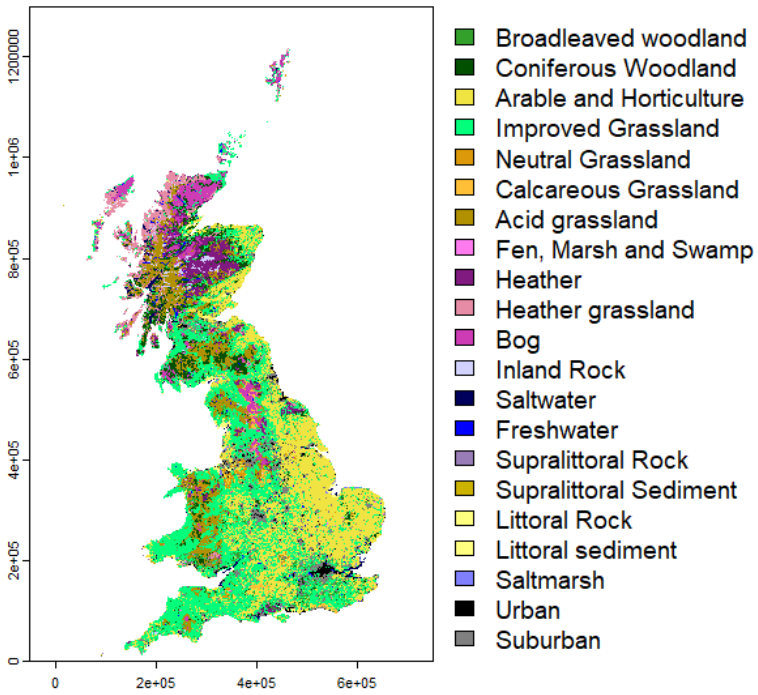

Figure 3 Land Cover Map categories in GB in 2021, data from Marston et al. (2022)

Northern Ireland

The Goodwin et al. (2022) paper did not include Northern Ireland as there was insufficient data available to apply the machine learning methodology. We propose four archetypes based on a qualitative assessment of information in the Northern Ireland Landscape Character Assessments (LCAs), combined with information from the GHG Inventory peat condition maps (Figure 4) and the Land Cover Map (Figure 5**Error! Reference source not found.**). Northern Ireland has large areas of peatland in the domestic extraction condition category in both upland and lowland areas (approximately 6% of the total area of NI). The dominant land cover is improved grassland, covering 71% of the country (**Error! Reference source not found.**).

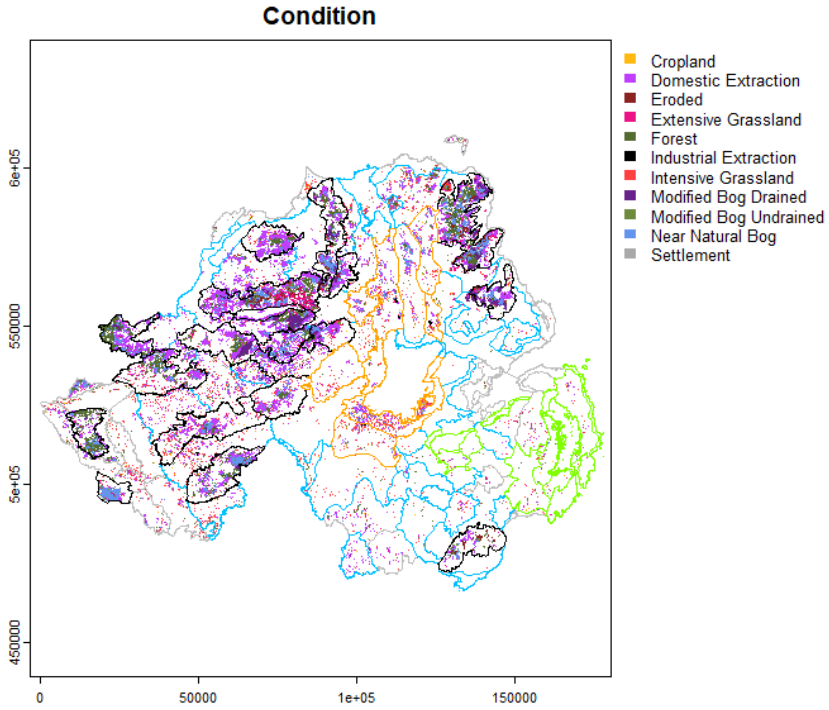

Figure 4: Peatland condition in NI (data from Clilverd et al., 2023) with all local LCA areas (grey), Archetype 11 (orange), Archetype 12 (black), Archetype 19 (blue) and Archetype 20 (green).

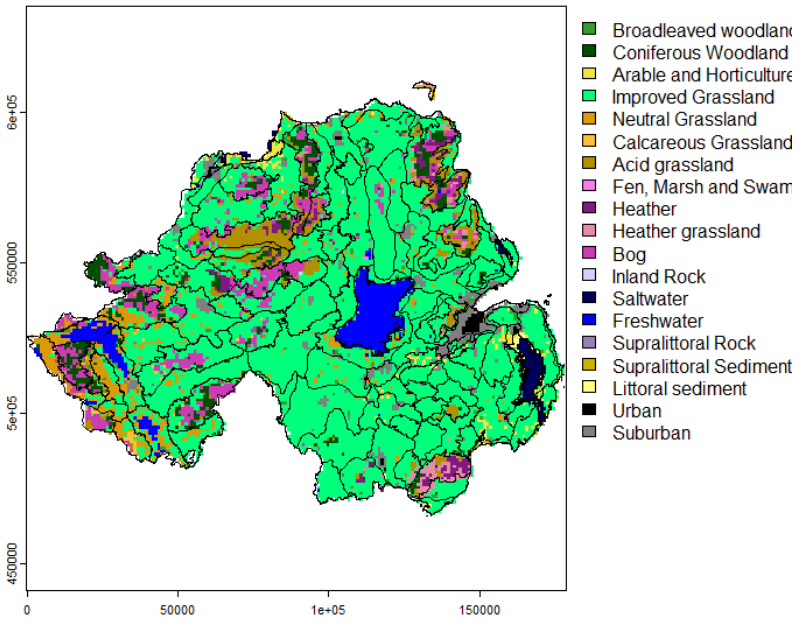

Figure 5 Land Cover map for NI in 2021 with local LCA area boundaries (black)

The Regional Landscape Character Assessment (2015[5]) describes the landscape in 26 regions (using natural, cultural and perceptual characteristics), including a high-level assessment of their landscape change drivers and ecosystem services. The Local Landscape Character Assessment (2000[6]) describes 130 localities in terms of their geology, land form, land use, cultural and ecological features. Many of the individual LCA documents have been updated since the original publication. Both LCA datasets can be viewed using the NI Environment Agency Natural Environment Map Viewer[7].

Archetypes have been developed using qualitative expert assessment based on the principal land-uses, descriptions in the Landscape Character Area documentation and occurrence of peatland types (either upland blanket bog or lowland raised bog). There are strong similarities between the Northern Ireland and GB archetypes, as discussed in section 4.2

3.2 Shortlisting

The longlist of 20 archetypes was reduced to a shortlist of 12 by considering a number of factors to include or exclude archetypes. The reasoning for including or

[5] https://daerani.maps.arcgis.com/apps/MapJournal/index.html?appid=3fdf82b3e41e44a1bb86a542dfb67d97

[6] https://www.daera-ni.gov.uk/articles/landscape-character-northern-ireland

[7] https://www.daera-ni.gov.uk/services/natural-environment-map-viewer

excluding each archetype are provided in the Archetype Details (section 4.2), however in general archetypes were included in the shortlist if they:

- characterised a distinct land use and management combination compared to other shortlisted archetypes;
- covered a substantial area of GB/NI; and/or
- have options for changing management of the land use in the future.

Archetypes were excluded from the shortlist for a number of reasons, including:

- Management Options: If an archetype has very limited options for changing how the land is managed in future it was not included in the shortlist.
- Overlap with other archetype: If an archetype is either a subset of another archetype, or is a very similar land use and management to another archetype, it was combined with that archetype.
- Lack of data: If there is a lack of data available to identify the locations of an archetype it was not shortlisted.
- Size of area covered: Archetypes covering a relatively small area of GB/NI compared to other archetypes in that DA were not shortlisted, although it is recognised that they may have significant opportunities for adaptation and resilience (e.g. coastal habitats).

Creating distinct archetypes in the shortlist

Due to the use of both Tier 1 and Tier 2 Goodwin et al. (2022) archetypes (which can overlap), and the definition of archetypes using the organic soils maps, there are areas in GB where a location could be assigned to multiple archetypes in the shortlist. To ensure each location is only assigned to one archetype, each 1km^2 grid cell was assigned according to the following hierarchy:

1. Organic soils archetypes: Grid cells were first assigned to one of the organic soils archetypes if applicable, as management options are likely to be similar across locations on organic soils
2. Goodwin et al. (2022) Tier 2 Archetypes: Grid cells not assigned to an organic soil archetype were assigned to one of the archetypes defined by a Tier 2 archetype, if applicable.
3. Goodwin et al. (2022) Tier 1 Archetypes: Finally, any grid cells not yet assigned to an archetype were assigned to one of the archetypes defined by a Tier 1 archetype, if applicable. If a location fell under both a Tier 1 and a Tier 2 archetype, it was assigned to the Tier 2 archetype, as these were defined with more detailed data relating to management than the Tier 1 archetypes.

For NI, all archetypes have been defined using the Local LCA areas and are already distinct from each other.

3.3 Emissions

Baseline estimates of Land Use, Land Use Change and Forestry (LULUCF) and Agriculture sector greenhouse gas emissions for each shortlisted archetype are provided. The emissions estimates are based on the 2021 national greenhouse gas emissions disaggregated for Local Authorities[8]. This is the most recent published Local Authority emissions data available and reflects the methodology in the 1990-2021 GHG Inventory.

Emissions for the archetypes are calculated based on the area of each Local Authority (LA) that they cover, with these steps followed for each archetype:

(1) Calculate the area of each LA covered by the archetype

(2) Convert the areas into the proportion of each LA covered by the archetype

(3) Multiply the proportions of each LA covered by the archetype by the emissions for each LA

(4) Sum the emissions from each LA to give the total for the archetype

The results shown are for the total LULUCF and Agriculture sector emissions, and not further broken down (e.g. into emissions from arable and livestock areas), so provide broad estimates to give indication of which archetypes are associated with higher/lower emissions. In future, a similar approach could be used to estimate the component emissions of the LULUCF and Agriculture sectors (such as emissions from livestock) based on the LA emissions, or emissions could be calculated for each archetype based on how the rural land in each archetype is used and managed to give improved estimates.

[8] https://www.gov.uk/government/statistics/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics-2005-to-2021

4. Land Use Archetypes

The following sections provide details for each of the archetypes, including soil, climate and agricultural use variations, land cover, emissions and mapping. Table 1 provides a list of all the longlisted archetypes, as well as the DAs they are mainly located in.

Table 1 Longlist of archetypes

#	Name	DA	Shortlist
1	Highly degraded lowland organic soils in GB	E	Yes
2	Degraded upland grazing land and forest on organic soils in GB	E, S	Yes
3	Intensive grassland in Wales and south-west England	E, W	Yes
4	Farming on the suburban fringe in England	E	Yes
5	Hilly farmland on improved and semi-natural grassland on non-organic soils in GB	E, S, W	Yes
6	Open pasture on the upland fringe in England and Scotland	E, S	Yes
7	Enclosed pasture in England and Wales	E, W	Yes
8	Acid grassland on hilly uplands in GB	S	Yes
9	Intensive and valley/floodplain arable on chalk/clay soils in England	E	Yes
10	Arable on sandy soils in England and Scotland	E, S	Yes
11	Lowland agriculture around Lough Neagh, Northern Ireland	NI	Yes
12	Uplands with large extent on organic soils in Northern Ireland	NI	Yes
13	Managed conifer on acidic, organic soils	E, S, W	No
14	Non-managed lowland broadleaf	E, S, W	No
15	Non-managed native trees upland		No
16	Horticulture on organic soils in England	E	No
17	Open farmland on sandy soils in Scotland	S	No
18	Valley/floodplain arable on clay loam in England	E	No
19	Improved grassland on mineral soils in Northern Ireland	NI	No
20	Lowland agriculture in south-east Northern Ireland	NI	No

Key: E = England, S = Scotland, W = Wales, NI = Northern Ireland

4.1 Shortlist Summaries

The following figures and tables summarise some of the key details for the shortlisted archetypes and differences between them.

Figure 6 shows the locations of the ten archetypes in GB. Based on the input data used in creating this set of archetypes, these are defined on a 1km square grid. In total, these archetypes cover approximately 47% of the total area of GB. Individual country maps are shown in Figures 7-9. The archetypes cover approximately 53% of England, 51% of Wales and 38% of Scotland.

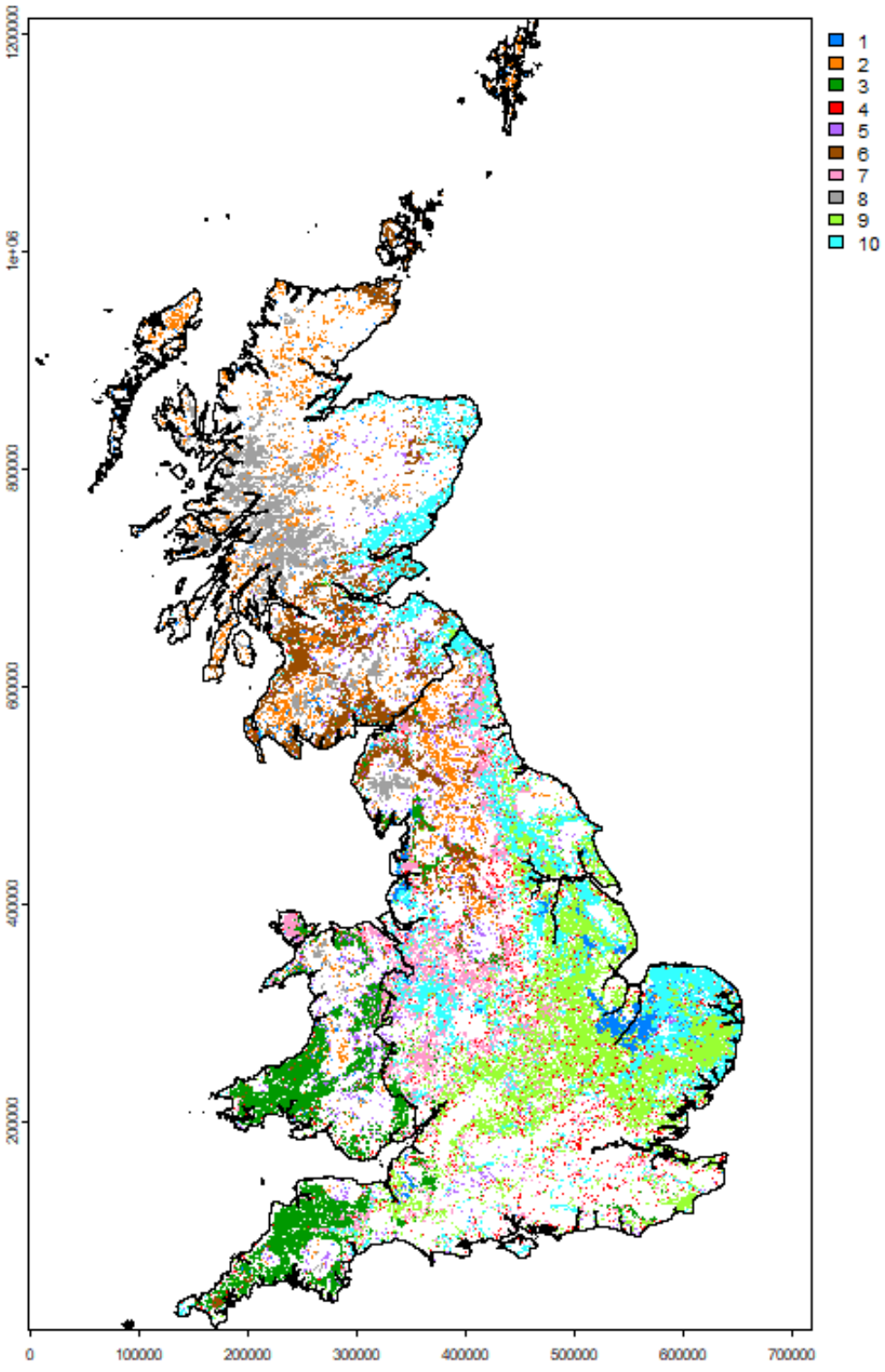

Figure 6 Shortlisted archetypes in GB

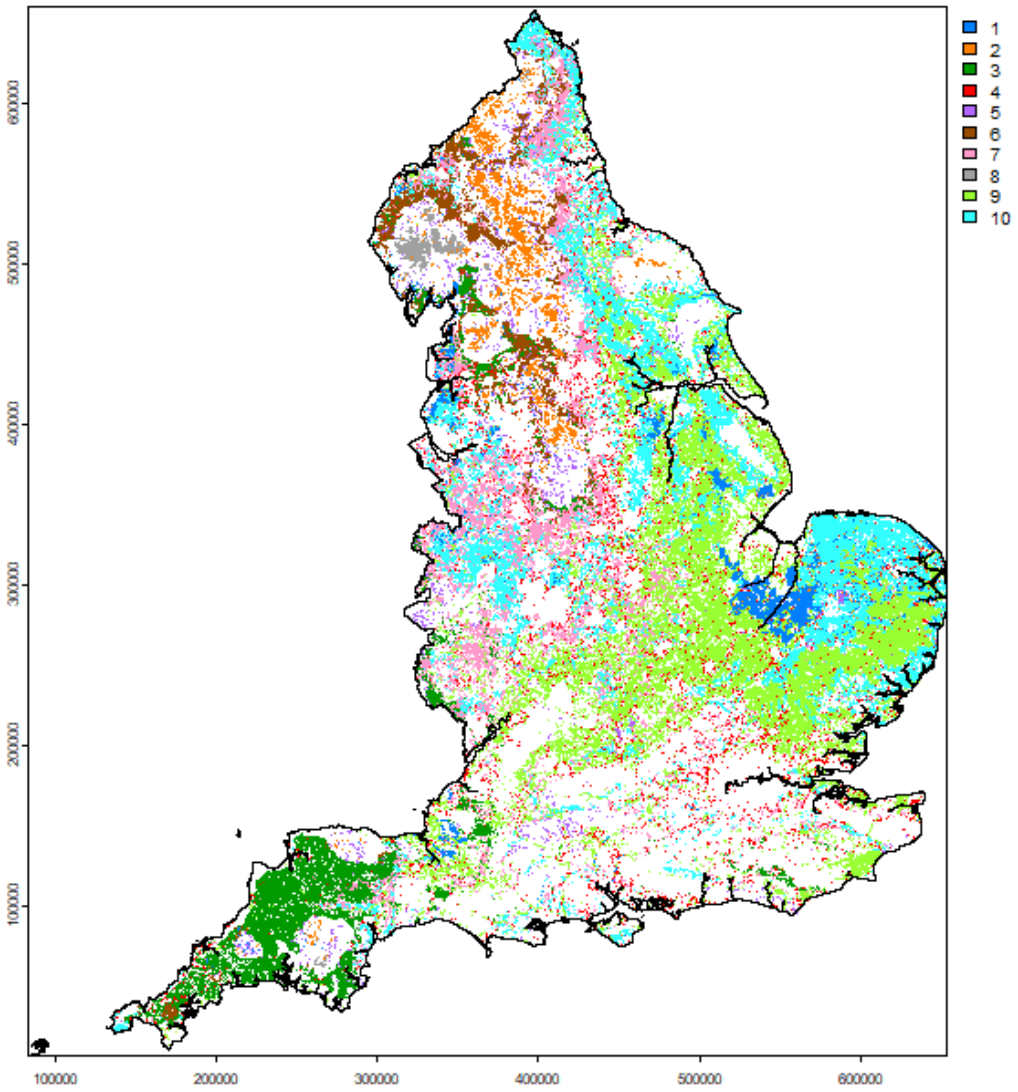

Figure 7 Shortlisted archetypes in England

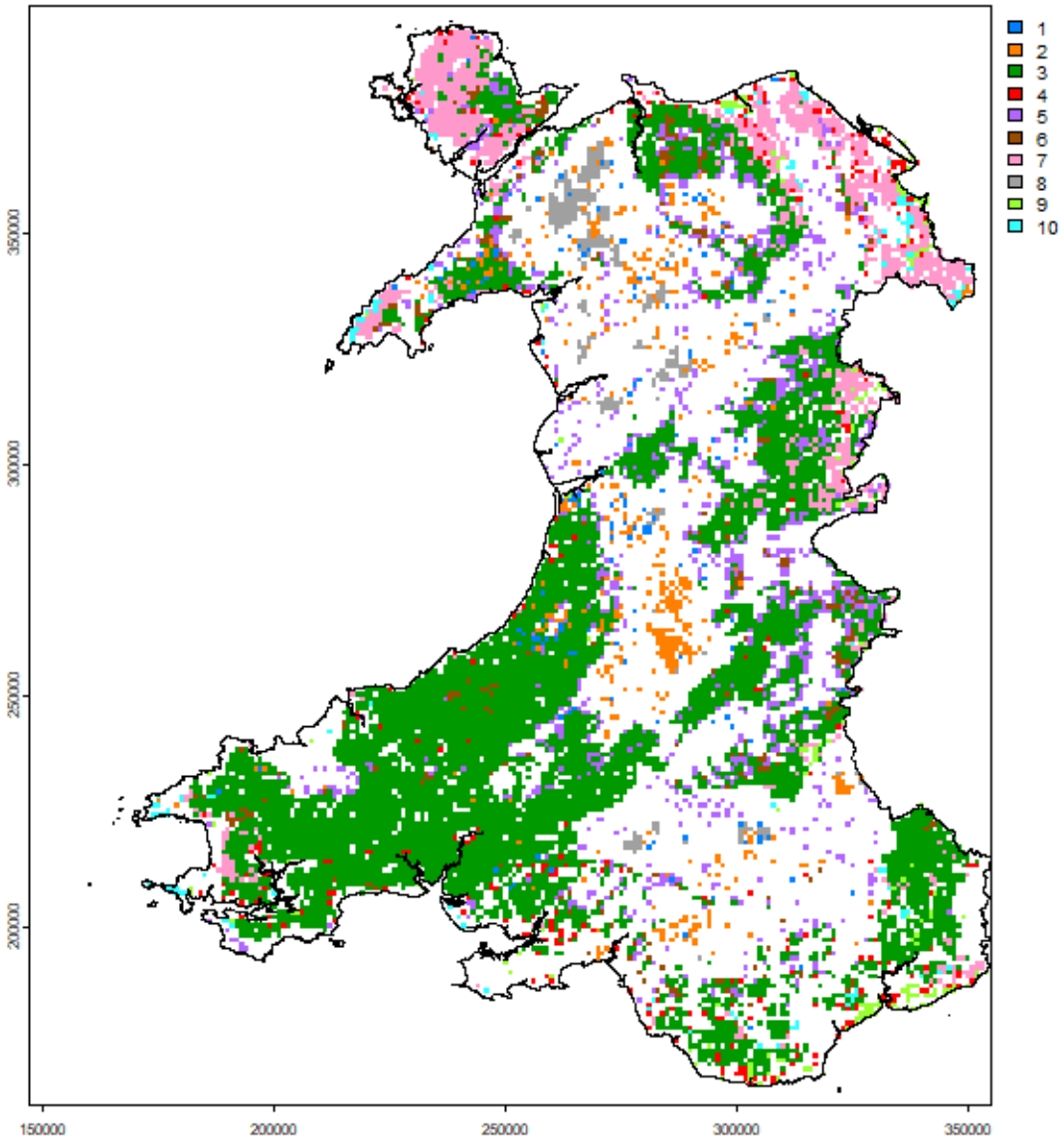

Figure 8 Shortlisted archetypes in Wales

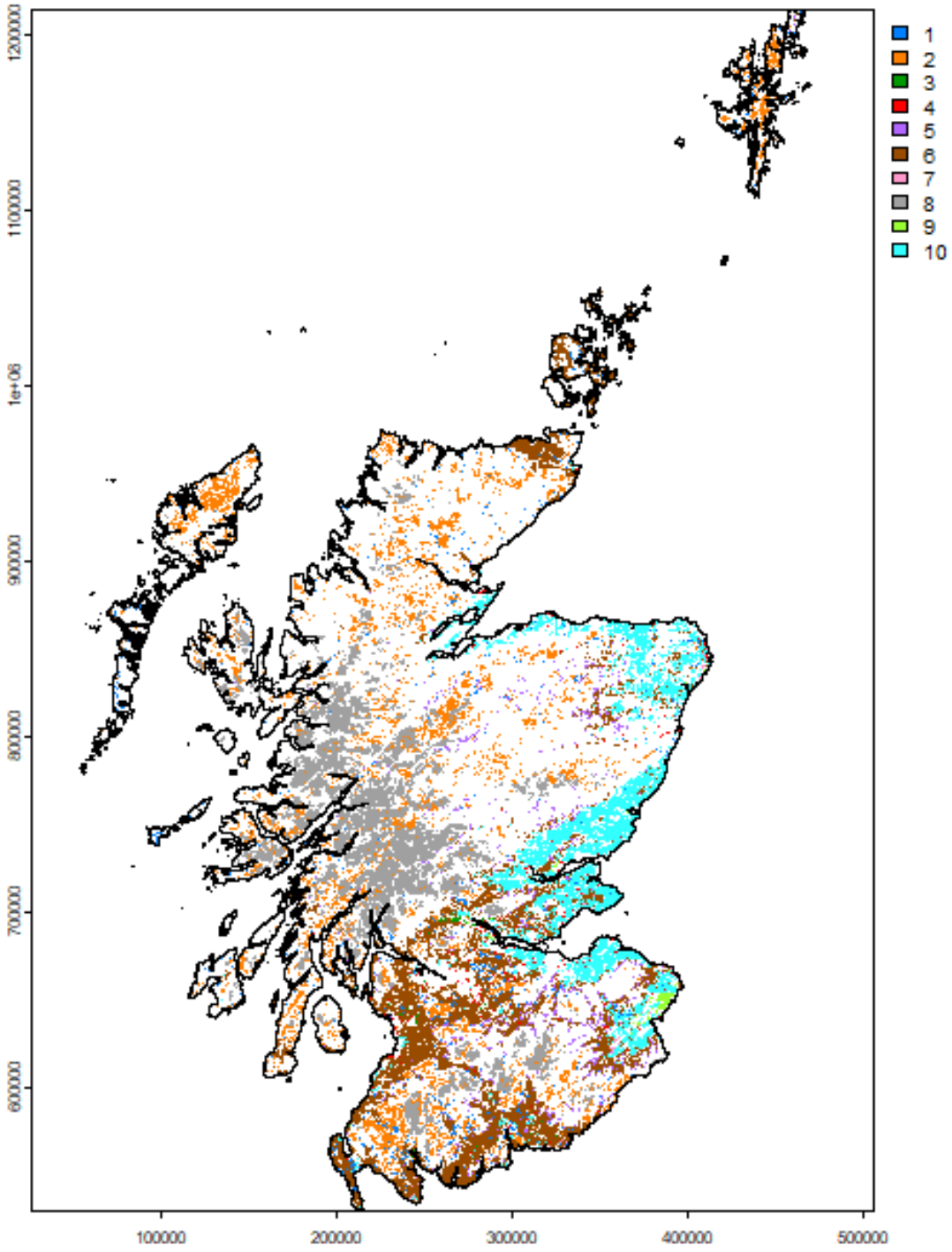

Figure 9 Shortlisted archetypes in Scotland

Figure 10 shows the locations of the two archetypes in NI. As these were defined using LCA areas, these are defined using polygons. In total, these archetypes cover approximately 31% of the total area of Northern Ireland.

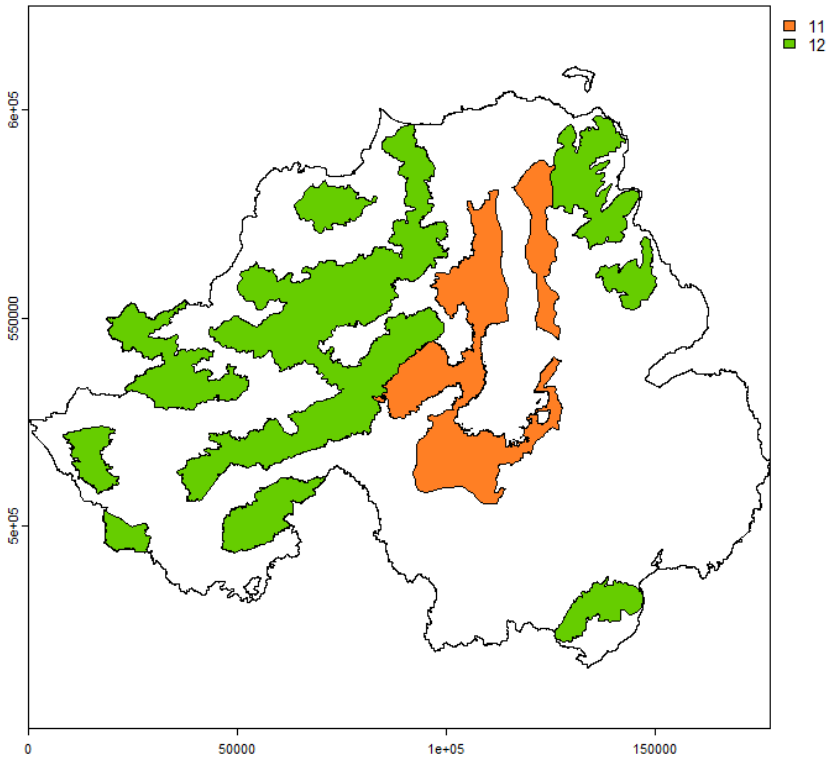

Figure 10 Shortlisted archetypes in NI

Table 2 highlights key differences in climate, soil drainage and moisture, and agricultural land grade and use for the archetypes. Archetypes span the range of climate variability in the UK from cooler to warmer and drier to wetter locations. The majority of archetypes are on mineral soils, but four have been specifically defined to include organic soil areas. The archetypes also include both drier and wetter soil moisture regions. The quality of the agricultural land varies across the archetypes. The main land uses are arable, livestock grazing on improved grassland and rough grazing, however further details are provided in the archetypes descriptions in section 4.2.

Table 3 shows the main land uses in each archetype, with areas calculated from the Land Cover Map for 2021 (Marston et al., 2022). Five of the archetypes are mostly Improved grassland, two are mostly Arable and horticulture, and one is mostly Acid grassland. Other land uses including woodland, semi-natural grasslands and suburban are also present across many of the archetypes.

Table 2 Summary of climate, soil and agricultural characteristics of the shortlisted archetypes

Archetype	Description	Main location	Climate	Soil drainage[9]	Soil moisture	Agricultural Land Class[10]	Predominant agricultural use	Area, '000 hectares
1	Highly degraded lowland organic soils	E, S	Cold winters, warm summers, relatively dry	Deep and wasted peats	Medium	ALC 2-3	Arable/horticulture and livestock grazing on improved grassland	**GB 406.4** *E 273* *S 117.3* *W 16.1*
2	Degraded upland grazing land and forest on organic soils in GB	E, S	Mild or cold winters, cool summers, relatively wet	Deep peats	Wet	ALC 5, SALC 4-6	Conifer plantation and livestock rough grazing	**GB 938.6** *E 269.5* *S 619.9* *W 49.2*
3	Intensive grassland in Wales and south-west England	E, W	Mild winters, warm summers, relatively wet	Mineral, Freely draining	Medium	ALC 3-4	Livestock grazing on improved grassland	**GB 1283.2** *E 640.1* *S 7.2* *W 634.8*
4	Farming on the suburban fringe in England	E	Mild or cold winters, warm summers, relatively dry	Mineral, Wide range	Dry-medium	ALC 1-4	Arable/horticulture and livestock grazing on improved grassland	**GB 608** *E 541.4* *S 33.5* *W 33.1*

[9] Scottish soils https://map.environment.gov.scot/Soil_maps/?layer=5 and NSRI Soilscapes

[10] The Agricultural Land Classification (ALC) system classes land into grades according to the extent to which physical r chemical characteristics impose long-term limitations on agricultural use for food production. This is the general ALC grade for the archetype, but the archetype may contain pockets of other ALC grades. The grades for England, Wales and Northern Ireland are Grade 1: Excellent Quality, Grade 2: Very Good Quality, Grade 3: Good to Moderate Quality, Grade 4: Poor Quality, Grade 5: Very Poor Quality. The Scottish ALC (SALC) classes are Class 1: Land capable of producing a very wide range of crops, Class 2: Land capable of producing a wide range of crops, Class 3: Land capable of producing average to high yields of a narrower range of crops, Class 4: Land capable of producing a narrow range of crops (primarily grassland with short arable breaks), Class 5: Land capable of use as improved grassland, Class 6: Land capable of use as rough grazings, Class 7: Land of very limed agricultural value.

5	Hilly farmland on improved and semi-natural grassland on non-organic soils in GB	E, S, W	Mild or cold winters, cool or warm summers, relatively wet	Mineral, slowly permeable	Medium-wet	ALC 4 SALC 4	Livestock rough grazing	**GB 424.5** *E 201* *S 106.4* *W 117.1*
6	Open pasture on the upland fringe in England and Scotland	E, S	Mild or cold winters, cool summers, relatively wet	Mineral, slowly permeable	Medium	ALC 3 SALC 3-4	Livestock grazing on improved and rough grassland	**GB 1148.3** *E 304.9* *S 814.3* *W 29.1*
7	Enclosed pasture in England and Wales	E, W	Mild or cold winters, cool or warm summers, relatively dry	Mineral, slowly permeable or freely draining	Medium	ALC 3	Livestock grazing on improved grassland with some arable	**GB 1051.1** *E 921.8* *S 9.9* *W 113.1*
8	Acid grassland on hilly uplands in GB	S	Mild winters, cool summers, relatively wet	Shallow, acidic soils, sometimes with surface water	Wet	ALC 5 SALC 6-7	Livestock rough grazing	**GB 860.9** *E 65.7* *S 767.4* *W 27.8*
9	Intensive and valley/floodplain arable on chalk/clay soils in England	E	Cold winters, warm summers, relatively dry	Lime-rich soils with variable drainage	Dry	ALC 1-3	Arable with some livestock on improved grassland	**GB 2172.6** *E 214.1* *S 12.9* *W 18.7*
10	Arable on sandy soils in England and Scotland	E, S	Cold winters, warm summers, relatively dry	Mineral, freely draining	Dry-medium	ALC 1-3	Arable with some livestock on improved grassland	**GB 2027.4** *E 1502.4* *S 511.9* *W 13.1*

11	Lowland agriculture around Lough Neagh, Northern Ireland	NI	Mild winters, cool summers, relatively wet	Poorly drained soils with peaty areas	Medium	ALC 3 (4 on peat)	Livestock grazing on improved grassland with some arable	**NI 122.8**
12	Uplands with large extent on organic soils in Northern Ireland	NI	Mild winters, cool summers, relatively wet	Deep organic soils	Wet	ALC 4	Livestock rough grazing	**NI 321.8**

Table 3 Land Cover Map categories in each archetype as a percentage of total archetype area. Darker colours represent higher percentages

Land cover / Arche-type	Broadleaved woodland	Coniferous Woodland	Arable and Horticulture	Improved Grassland	Neutral Grassland	Calcareous Grassland	Acid grassland	Fen, Marsh and Swamp	Heather	Heather grassland	Bog	Inland Rock	Saltwater	Freshwater	Supralittoral Rock	Supralittoral Sediment	Littoral Rock	Littoral sediment	Saltmarsh	Urban	Suburban
1	2%	2%	48%	29%	3%	0%	6%	1%	1%	4%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2	2%	34%	1%	3%	0%	0%	11%	0%	11%	7%	28%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3	1%	0%	5%	93%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4	0%	0%	38%	47%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	8%
5	2%	1%	3%	52%	5%	10%	22%	1%	1%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6	1%	1%	3%	89%	0%	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7	0%	0%	11%	84%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
8	0%	2%	0%	0%	0%	0%	79%	0%	6%	5%	3%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%
9	0%	0%	80%	18%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10	1%	1%	87%	10%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11	1%	0%	0%	85%	5%	0%	0%	0%	0%	0%	1%	0%	0%	5%	0%	0%	0%	0%	0%	0%	3%
12	1%	13%	0%	41%	3%	1%	15%	0%	5%	3%	19%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Emissions estimates for the shortlisted archetypes (Table 4, Figures 6-10) show variation across the archetypes, with net LULUCF emissions ranging from -0.5 t CO_2e/ha (negative emissions indicate removals) to +2.3 t CO_2e/ha. Archetypes 1 (Highly degraded lowland organic soils in GB), 11 (Lowland agriculture around Lough Neagh, NI) and 12 (Uplands with a large extent on organic soils, NI) have the largest LULUCF emissions per area. Agriculture emissions range from 0.9 to 5.0 t CO_2e/ha, with greatest emissions per area generally associated with archetypes with livestock on improved grassland.

Table 4 LULUCF and Agriculture emissions estimates for 2021 for the shortlisted archetypes

Archetype	LULUCF emissions			Agriculture emissions		
	Total emissions (kt CO_2e)	Proportion of UK LULUCF emissions	Emissions per ha (t CO_2e/ha)	Total emissions (kt CO_2e)	Proportion of UK agriculture emissions	Emissions per ha (t CO_2e/ha)
1	924	30%	2.3	1078	2%	2.7
2	162	5%	0.2	1283	3%	1.4
3	-619	-20%	-0.5	4294	8%	3.3
4	6	0%	0.0	1339	3%	2.2
5	-75	-2%	-0.2	979	2%	2.3
6	-21	1%	0.0	2351	5%	2.0
7	-364	-12%	-0.3	3102	6%	3.0
8	-195	-6%	-0.2	740	1%	0.9
9	662	21%	0.3	4553	9%	2.1
10	1043	33%	0.5	4314	9%	2.1
11	166	5%	1.3	610	1%	5.0
12	594	19%	1.8	1243	2%	3.9

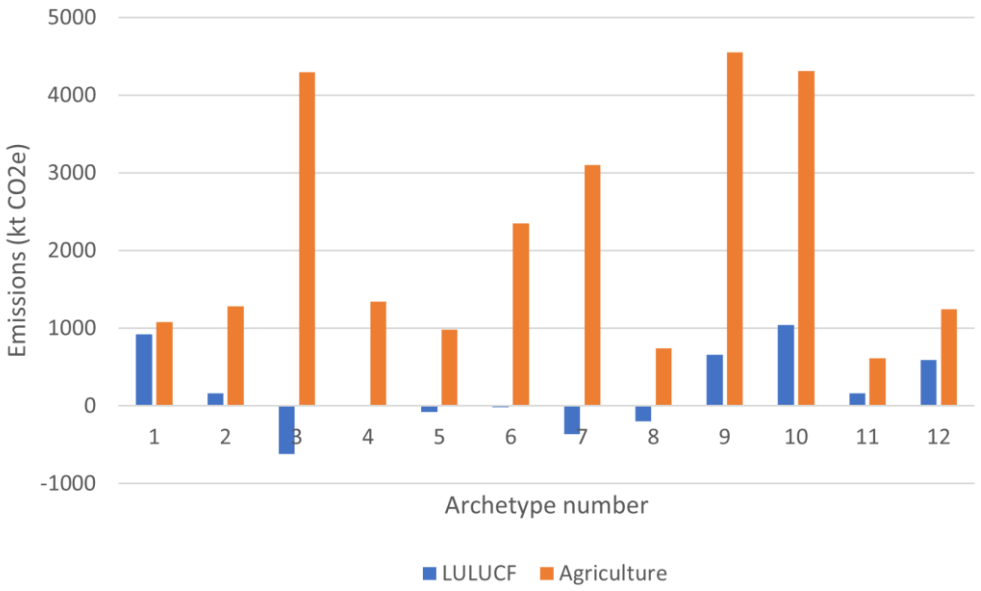

Figure 11 Total emissions for LULUCF and Agriculture in 2021 for each archetype, in kt CO_2e

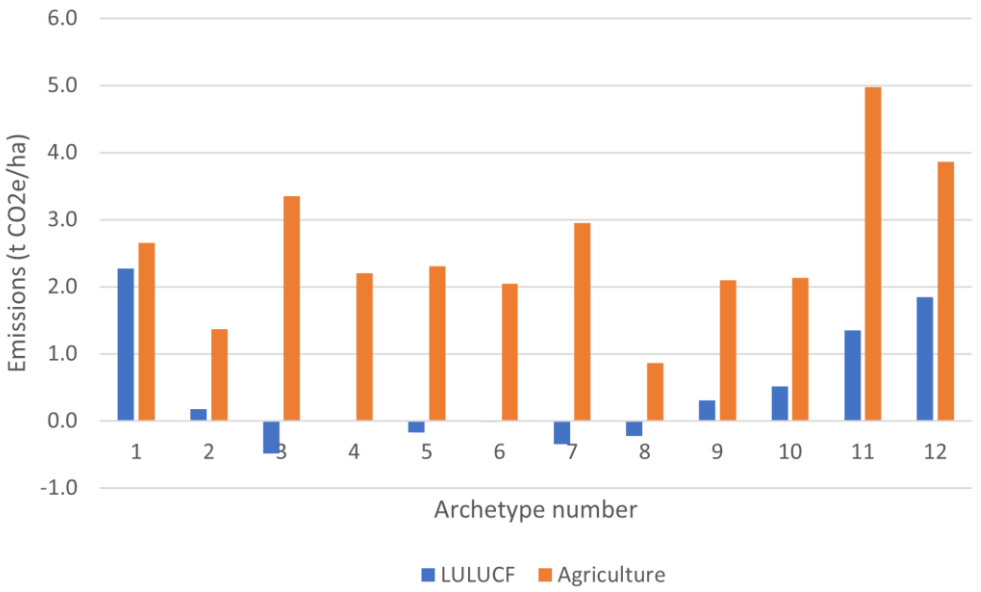

Figure 12 Emissions per hectare for LULUCF and Agriculture in 2021 for each archetype, in kt CO_2e/ha

4.2 Archetype Details

Archetype 1: Highly degraded lowland organic soils in GB

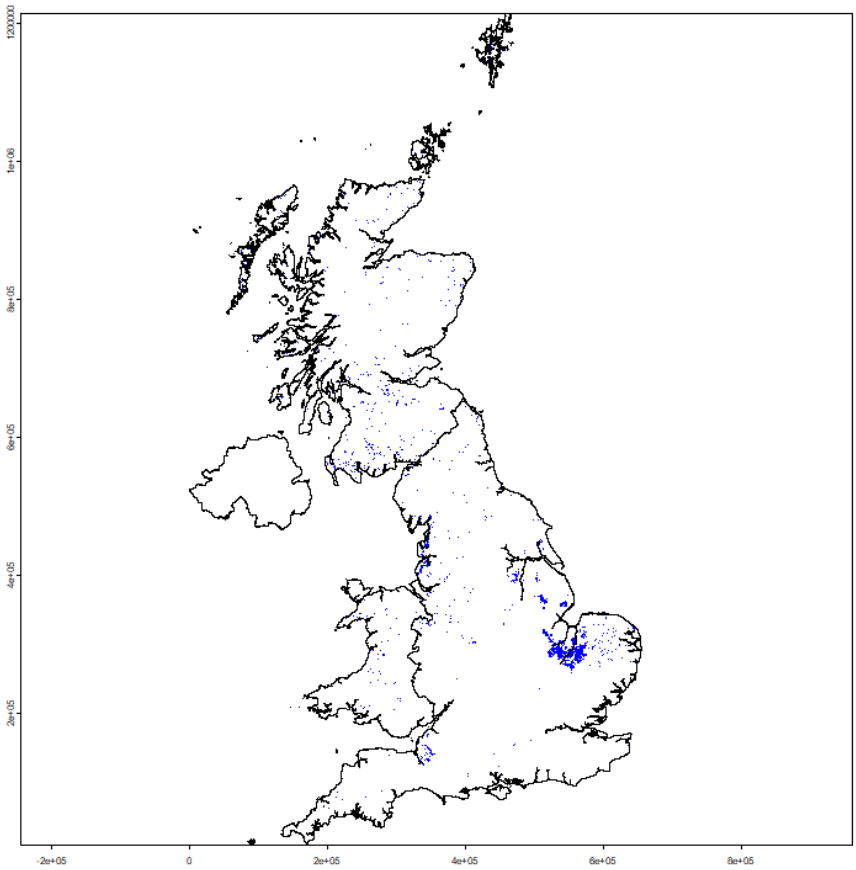

Figure 13 Locations of Archetype 1: Highly degraded lowland organic soils in GB

Figure 14 Archetype 1 representative photos. Left and Centre: The Fens, England; Right: Somerset Levels, England.

Shortlist: Yes. Although this archetype covers a relatively small area, it has some of the highest LULUCF emissions per hectare, and there are a range of management options that could be considered to reduce emissions in the future, e.g. total restoration to a near-natural state, raising of the water table, reduction of livestock grazing.

Source: Clilverd et al. (2023) peat condition maps. Mapped locations of Cropland, Intensive grassland, Extensive grassland and Peat extraction
Area: 406,400 ha (4064km^2)
Coverage of land area: England 2%, Scotland 1%, Wales 1%
Spatial scale: Landscape scale in the Fens, scattered elsewhere

Emissions in 2021: LULUCF 2.3 t CO_2e/ha, Agriculture 2.7 t CO_2e/ha

Description:

- Largest areas are located around the Fens in Eastern England, with smaller areas across the rest of GB
- All on organic soils
- Land use is mostly Arable/horticulture (48%) and improved grassland (29%), with smaller areas of acid grassland, heather grassland, bog, and neutral grassland (Figure 15, Table 3)

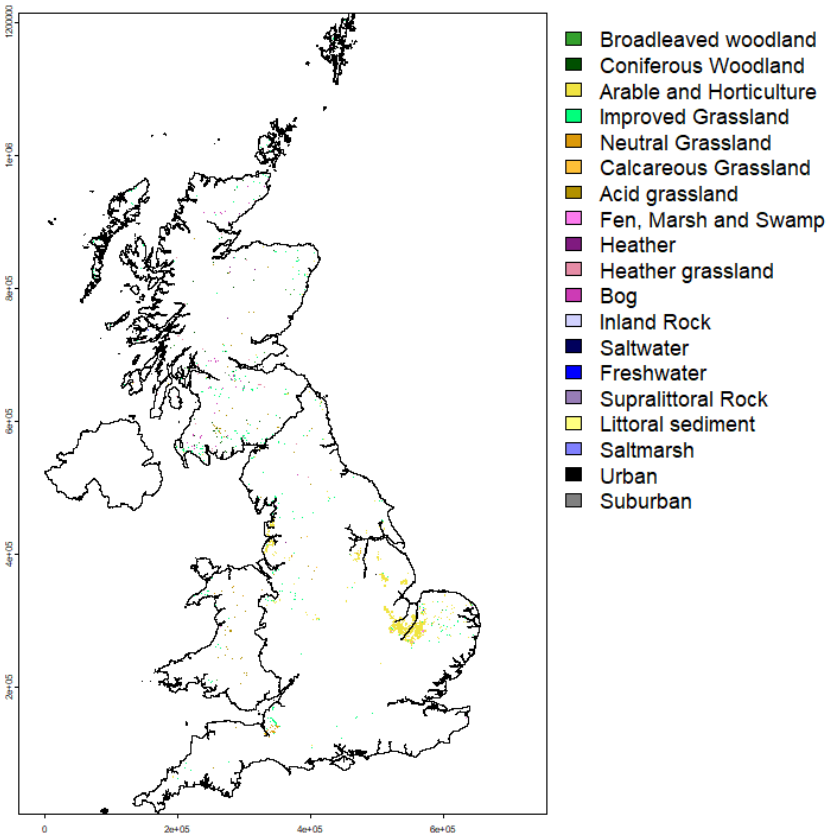

Figure 15 Land Cover Map categories at the locations of Archetype 1

Archetype 2: Degraded upland grazing land and forest on organic soils in GB

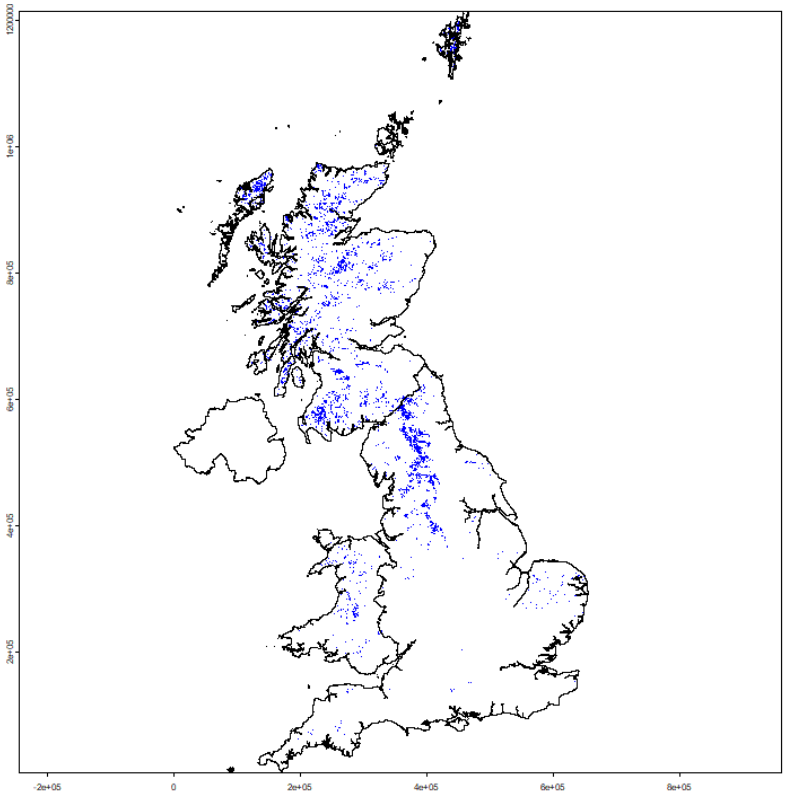

Figure 16 Locations of Archetype 2: Degraded upland grazing land and forest on organic soils in GB

Figure 17 Archetype 2 representative photos. Left: Southwest Scotland; Centre and Right: Northern England.

Shortlist: Yes. This archetype covers a large area across Scotland and Northern England, and there are specific management options that can be applied to organic soils compared to mineral soils.

Source: Clilverd et al. (2023) peat condition maps. Mapped locations of Eroded, Modified bog drained, Modified bog undrained, Forest
Area: 938,600 ha (9386km^2)
Coverage of land area: England 2%, Scotland 8%, Wales 2%
Spatial scale: Locations are generally scattered, but with a more well-defined area around the Pennines in northern central England

Emissions in 2021: LULUCF 0.2 t CO_2e/ha, Agriculture 1.4 t CO_2e/ha

Description:

- Located mainly in Scotland, northern England, and Wales
- All on organic soils
- Land use is mostly Coniferous woodland (34%), Bog (28%), Acid grassland and Heather, with smaller areas of Heather grassland, Improved grassland, broadleaved woodland and arable/horticulture (Figure 18, Table 3)

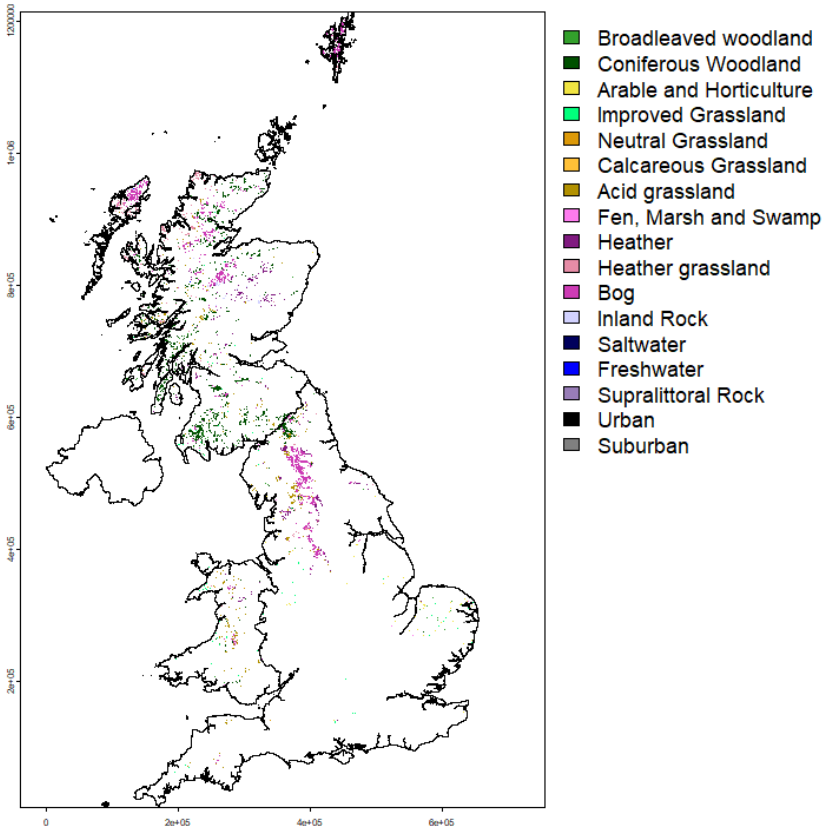

Figure 18 Land Cover Map categories at the locations of Archetype 2

Archetype 3: Intensive grassland in Wales and south-west England

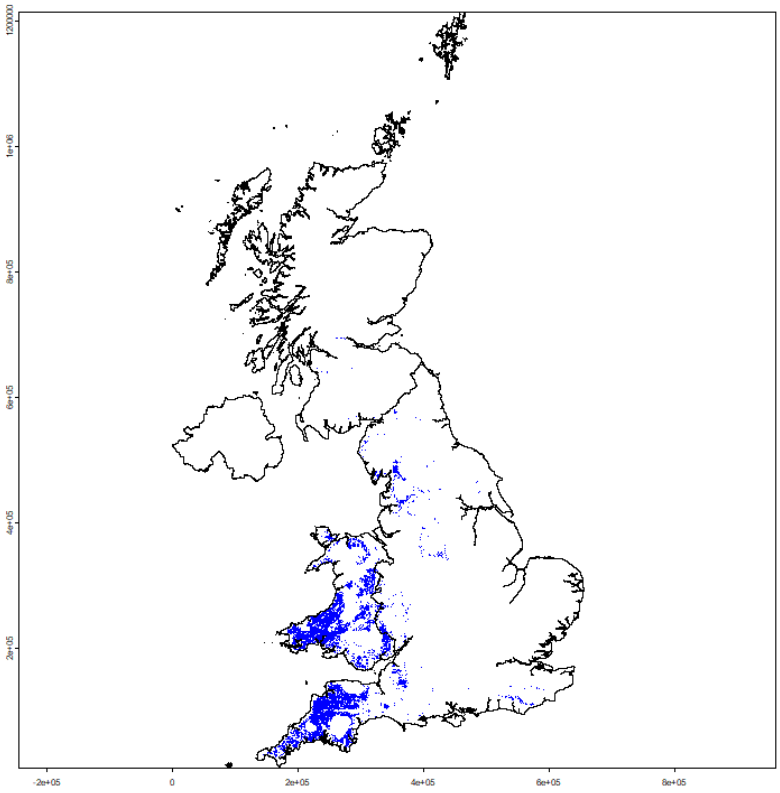

Figure 19 Locations of Archetype 3: Intensive grassland in Wales and south-west England

Figure 20 Archetype 3 representative photos. Left: Cornwall, England. Right: South Wales

Shortlist: Yes. This archetype covers a large area of Wales and South West England and has distinct land management differences from the other archetypes.

Source: Goodwin et al. (2022) Tier 2 archetype number 12 (Pasture in enclosed, hilly areas), with any degraded lowland or upland organic soil locations assigned to Archetypes 1 and 2 (around 1% of this land is assigned to the organic soil archetypes)
Area: 1,282,100 ha (12821km^2)
Coverage of land area: England 5%, Scotland <1%, Wales 31%
Spatial scale: Landscape scale – locations are in large, well-defined broad areas in Wales and south-west England with a few more scattered locations

Emissions in 2021: LULUCF -0.5 t CO_2e/ha, Agriculture 3.3 t CO_2e/ha

Description:

- Mainly located in Wales and Southwest England, with a few locations elsewhere in England
- Hilly areas with silty soils and a relatively wet climate
- Land cover mostly intensive grassland (93%) (Figure 18, Table 3), with hedgerows dividing up fields
- Land used for dairy farming, beef, sheep and horses

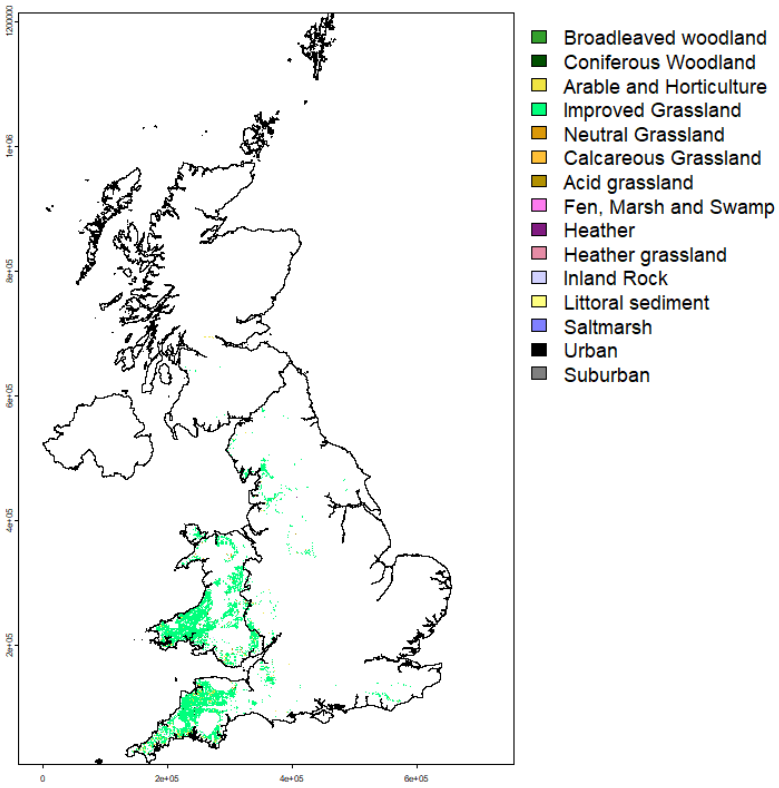

Figure 21 Land cover map categories at the locations of Archetype 3

Archetype 4: Farming on the suburban fringe in England

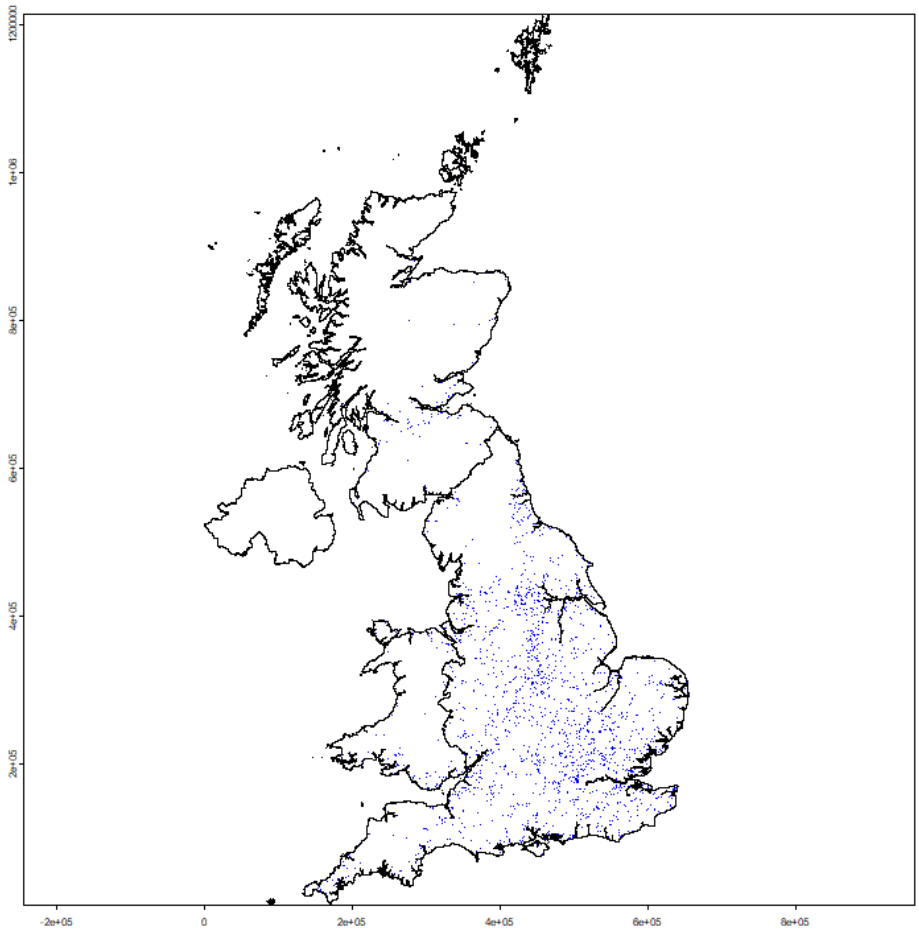

Figure 22 Locations of Archetype 4: Farming on the suburban fringe in England

Figure 23 Archetype 4 representative photos. Left: Central England, Centre and Right: Southern England

Shortlist: Yes. Although covering a relatively small area and very scattered locations, this archetype has a unique set of pressures from its suburban location such as increased need for housing and demand for recreational green space.

Source: Goodwin et al. (2022) Tier 2 archetype number 9 (Farming on suburban fringes), with any degraded lowland or upland organic soil locations assigned to Archetypes 1 and 2 (around 1% of this land is assigned to the organic soil archetypes)
Area: 608,000 ha **(**6080)km^2
Coverage of land area: England 4%, Scotland <1%, Wales 2%
Spatial scale: Farm scale – very scattered locations due to definition by proximity to urban areas

Emissions in 2021: LULUCF 0.0 t CO_2e/ha, Agriculture 2.2 t CO_2e/ha

Description

- Farmland near to urban areas, mostly in England with some locations in Wales and Scotland
- Mix of improved grassland (47%) and arable/horticulture (38%), with some areas (11%) classed as suburban or urban in the Land Cover Map (Figure 24, Table 3)
- Land uses are a broad range of farming including arable, vegetable growing, livestock, horse paddocks and agri-tourism

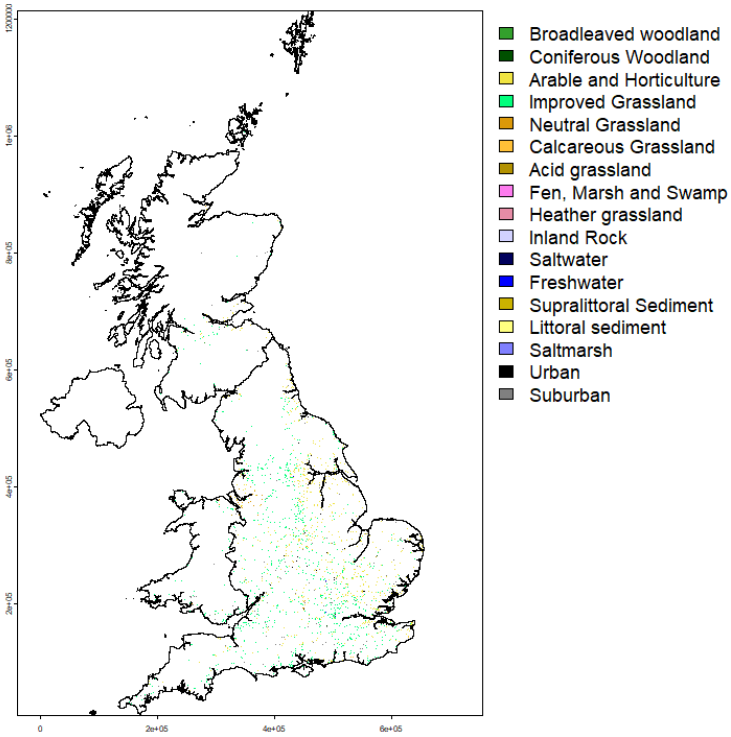

Figure 24 Land cover map categories at locations of Archetype 4

Archetype 5: Hilly farmland on improved and semi-natural grassland on non-organic soils in GB

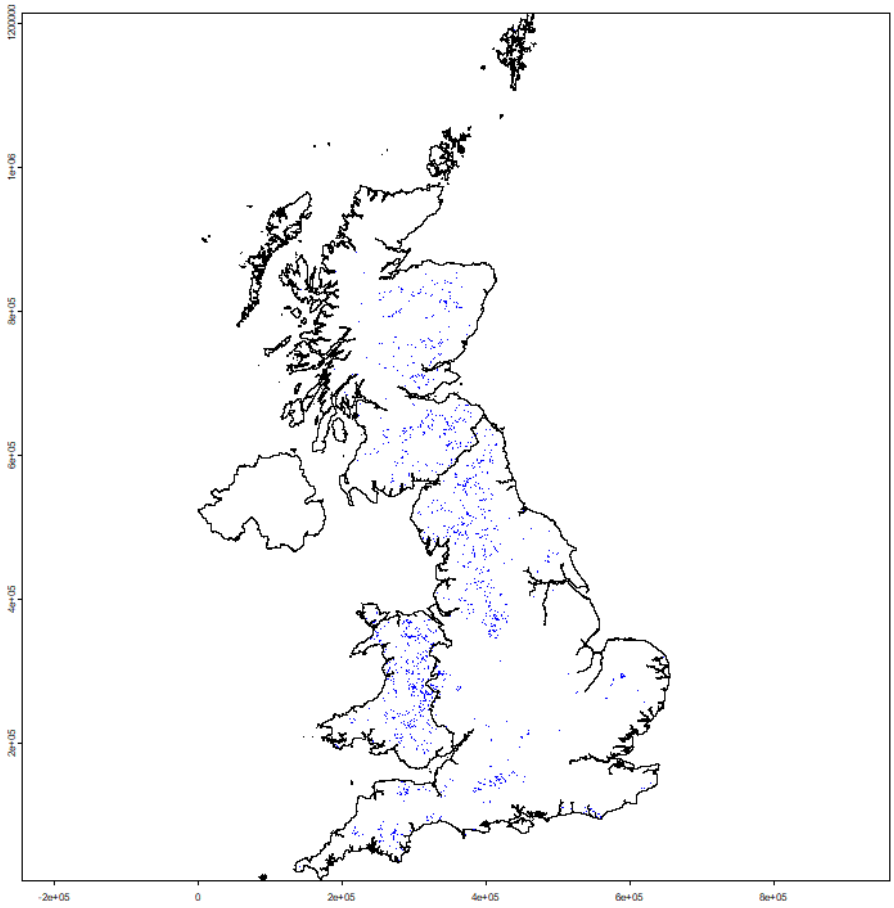

Figure 25 Locations of Archetype 5: Hilly farmland on improved and semi-natural grassland on non-organic soils in GB

Figure 26 Archetype 5 representative photo: West Wales.

Shortlist: Yes. Covers a relatively small area but is present across England, Scotland and Wales and represents a distinct land use and management archetype due to the hilly landscape.

Source: Goodwin et al. (2022) Tier 2 archetype number 6 (Hilly farmland with semi-natural grasslands) with any degraded lowland or upland organic soil locations assigned to Archetypes 1 and 2 (around 3% of this land was assigned to the organic soil archetypes)
Area: 424,500 ha (4245km^2)
Coverage of land area: England 2%, Scotland 1%, Wales 6%
Spatial scale: Farm scale – scattered locations across GB

Emissions in 2021: LULUCF -0.2 t CO_2e/ha, Agriculture 2.3 t CO_2e/ha

Description

- Mostly located in Wales, northern England and southern/eastern Scotland
- Hilly, with relatively wet and cool climate
- Mostly a mix of improved (52%) and semi-natural grasslands (acid, calcareous, neutral, heather) (40%) (Figure 27, Table 3)
- Primarily rough grazing (beef and sheep) with some improved pasture, paddocks and agri-tourism

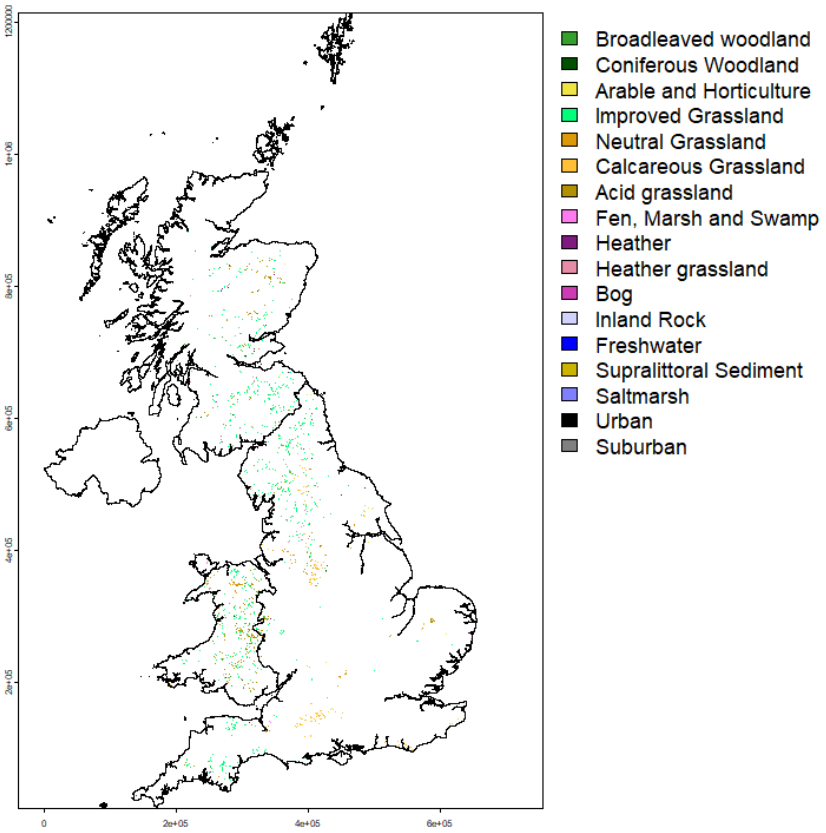

Figure 27 Land cover map categories at locations of Archetype 5

Archetype 6: Open pasture on the upland fringe in England and Scotland

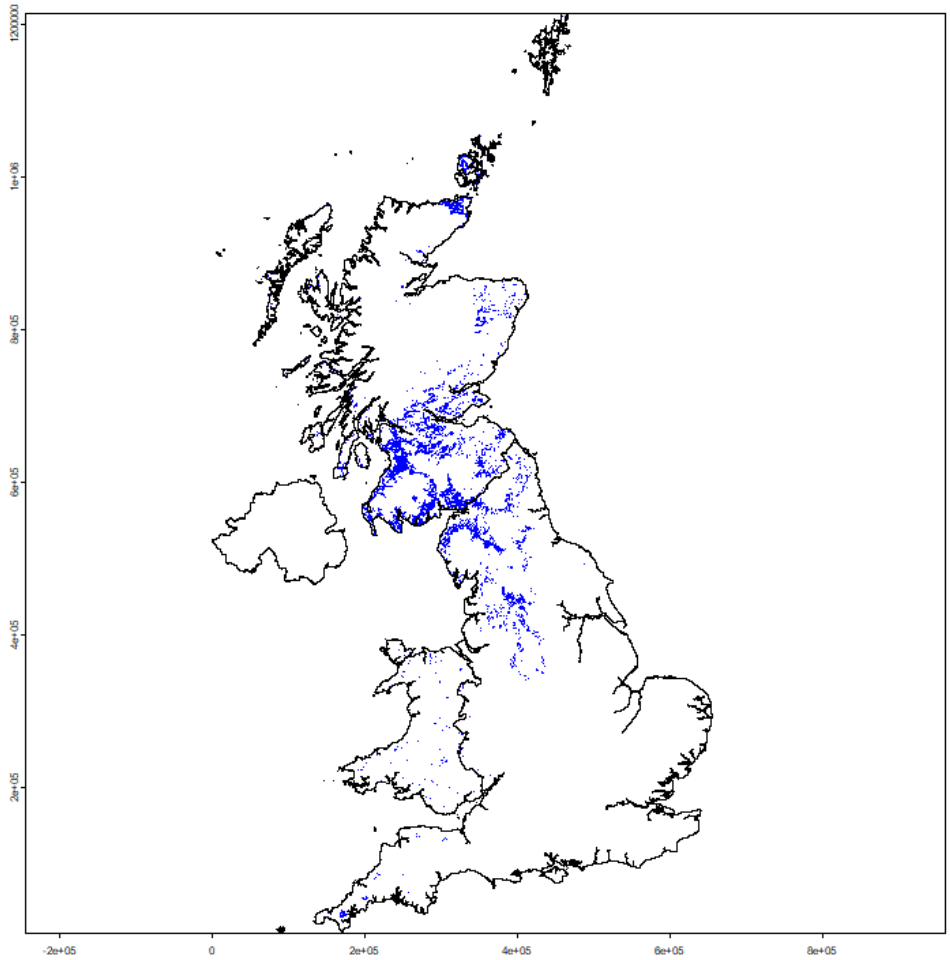

Figure 28 Locations of Archetype 6: Open pasture on the upland fringe in England and Scotland

Figure 29 Archetype 6 representative photos. Left: Northwest England, Right: Southeast Scotland.

Shortlist: Yes. Covers a distinct area of northern England and southern Scotland with specific pressures and management options due to its upland margin locations.

Source: Goodwin et al. (2022) Tier 2 archetype number 7 (Open pastures on the upland fringe), with any degraded lowland or upland organic soil locations assigned to Archetypes 1 and 2 (around 1% of this land was assigned to the organic soil archetypes)
Area: 1,148,300 ha (11483km^2)
Coverage of land area: England 2%, Scotland 10%, Wales 1%
Spatial scale: Landscape scale – located mainly in broad upland fringe areas in Northern England and southern Scotland with some scattered locations elsewhere

Emissions in 2021: LULUCF 0.0 t CO_2e/ha, Agriculture 2.0 t CO_2e/ha

Description

- Mainly located in Northern England, Southern Scotland, and far North Scotland
- Relatively sandy soils and wet and cool climate
- Predominantly improved grassland (89%), with small areas of acid and heather grassland (4%) and arable and horticulture (3%) (Figure 30, Table 3).
- Few hedgerows dividing up fields
- Land use mostly beef and sheep farming on improved pasture, some rough grazing

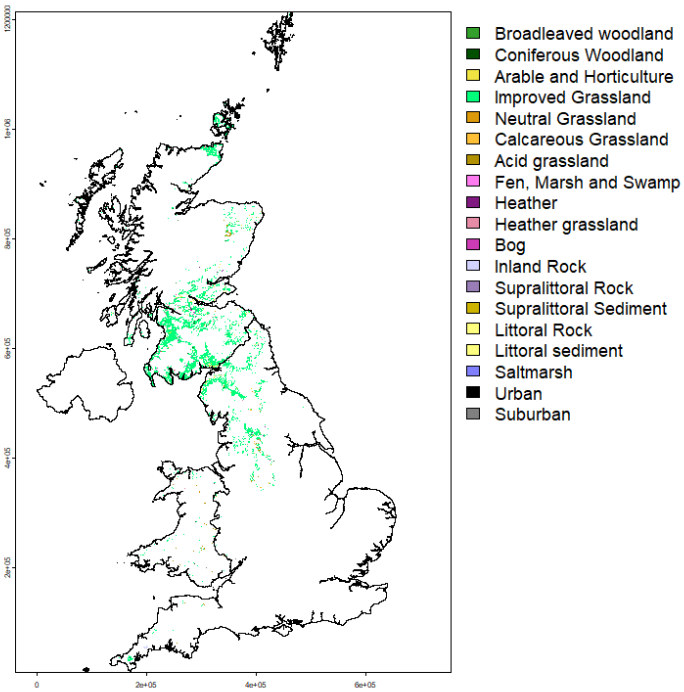

Figure 30 Land cover map categories at locations of Archetype 6

Archetype 7: Enclosed pasture in England and Wales

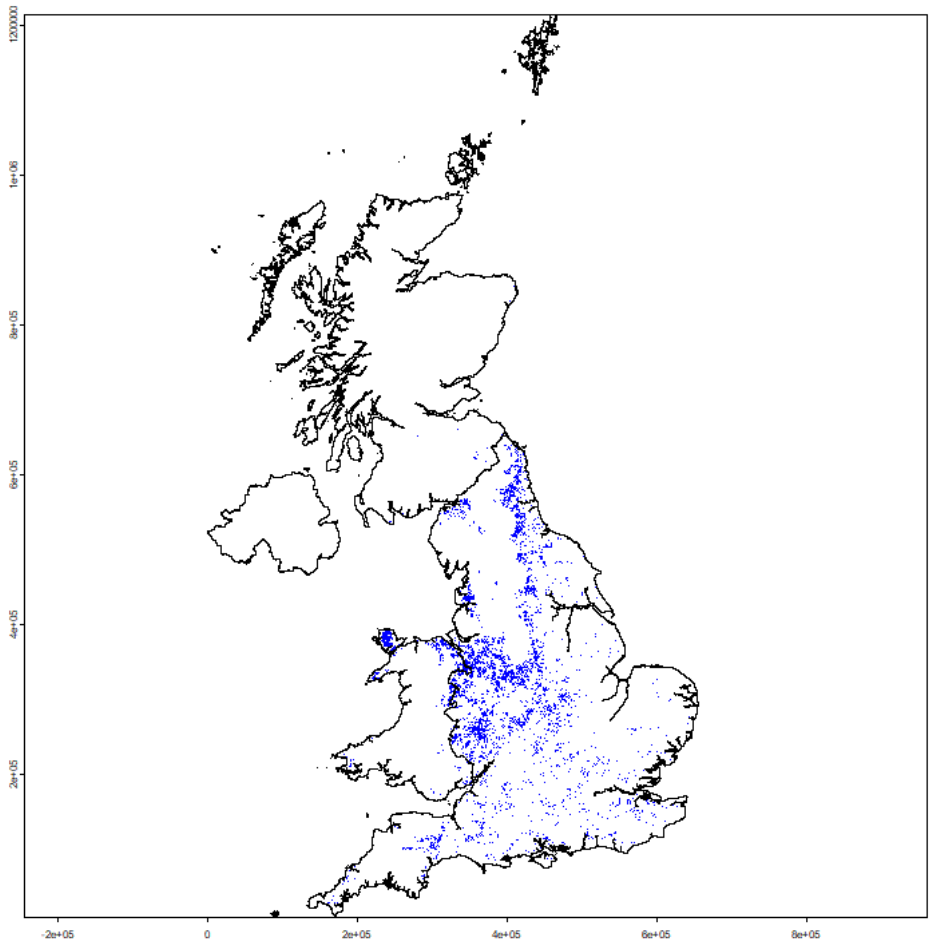

Figure 31 Locations of Archetype 7: Enclosed pasture in England and Wales

Figure 32 Archetype 7 representative photos. Left: West Wales, Centre: Peak District, England, Right: Southern England.

Shortlist: Yes. Covers a large area, particularly of England.

Source: Goodwin et al. (2022) Tier 2 archetype number 8 (Enclosed pasture), with any degraded lowland or upland organic soil locations assigned to Archetypes 1 and 2 (around 1% of this land was assigned to the organic soil archetypes)
Area: 1,051,100 ha (10511km^2)
Coverage of land area: England 7%, Scotland <1%, Wales 5%
Spatial scale: Farm scale – scattered locations across England and Wales, mostly clustered around west-central England

Emissions in 2021: LULUCF -0.3 t CO_2e/ha, Agriculture 3.0 t CO_2e/ha

Description

- Located mostly in England and North Wales
- Hedgerows divide relatively small fields
- Improved grassland (84%) with some arable/horticulture (11%), and neutral grassland mainly around England/Wales border (4%) (Figure 33)
- Land uses include dairy farming, mixed livestock and arable farming

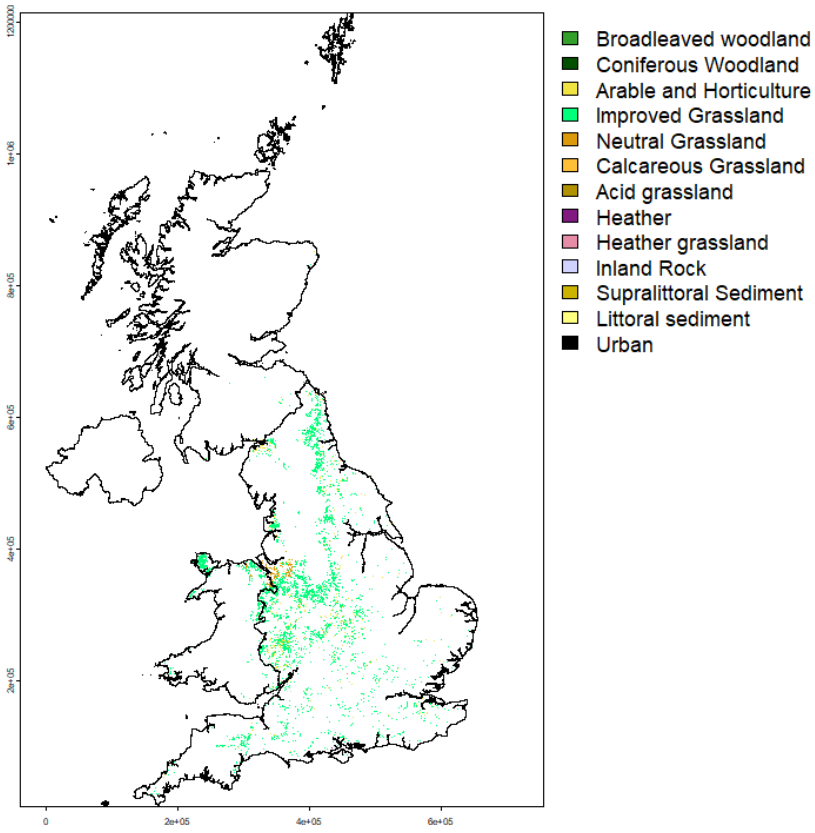

Figure 33 Land cover map categories at locations of Archetype 7

Archetype 8: Acid grassland on hilly uplands in GB

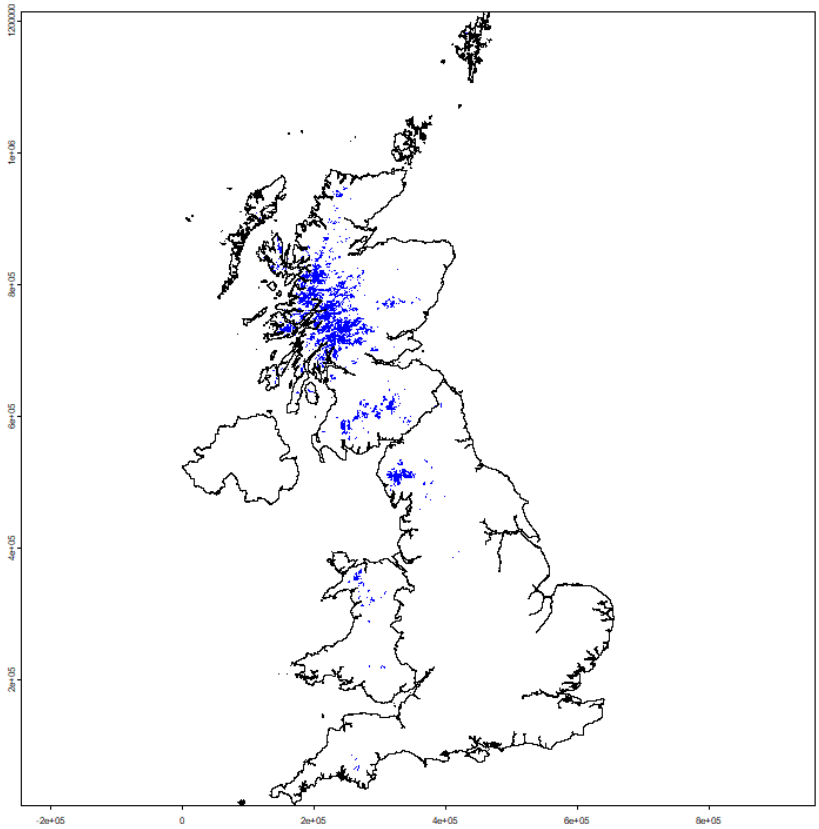

Figure 34 Locations of Archetype 8: Acid grassland on hilly uplands in GB

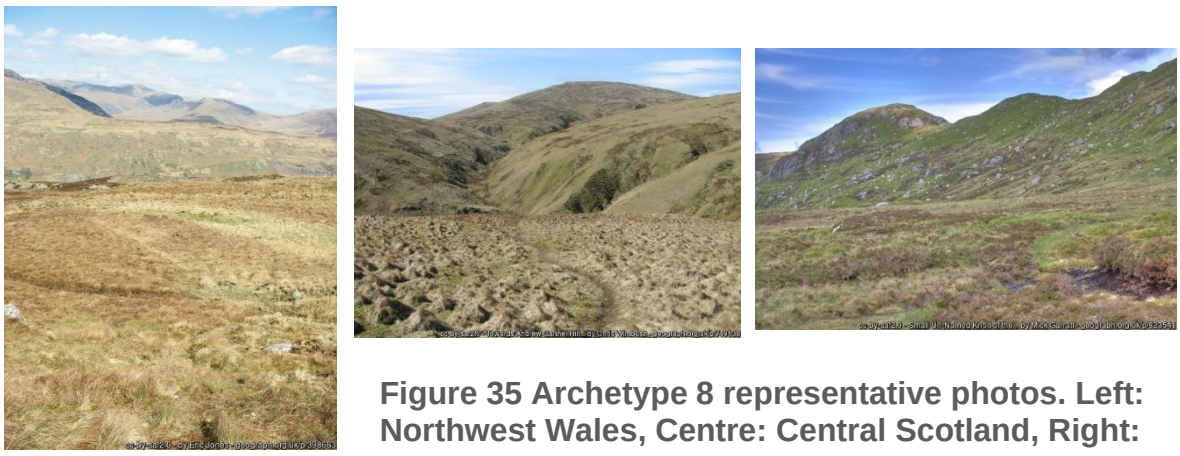

Figure 35 Archetype 8 representative photos. Left: Northwest Wales, Centre: Central Scotland, Right: Scotland.

Shortlist: Yes. Covers a large proportion of land area in Scotland.

Source: Goodwin et al. (2022) Tier 1 archetype number 1 (Acid grassland on variable upland), with any degraded lowland or upland organic soil locations assigned to Archetypes 1 and 2 (around 5% of this land was assigned to the organic soil archetypes)
Area: 860,900 ha (8609km^2)
Coverage of land area: England 1%, Scotland 10%, Wales 1%
Spatial scale: Landscape scale – mostly located in a broad, well-defined area of Scotland, with some smaller but also well-defined areas

Emissions in 2021: LULUCF -0.2 t CO_2e/ha, Agriculture 0.9 t CO_2e/ha

Description

- Located mostly in Scotland, particularly Western Scotland, with smaller areas in NW England and NW Wales
- High elevation, hilly land with relatively wet and cool climate and low soil pH
- Predominantly acid grassland (79%) with some smaller areas of heather (6%) and heather grassland (5%) (Figure 36, Table 3)

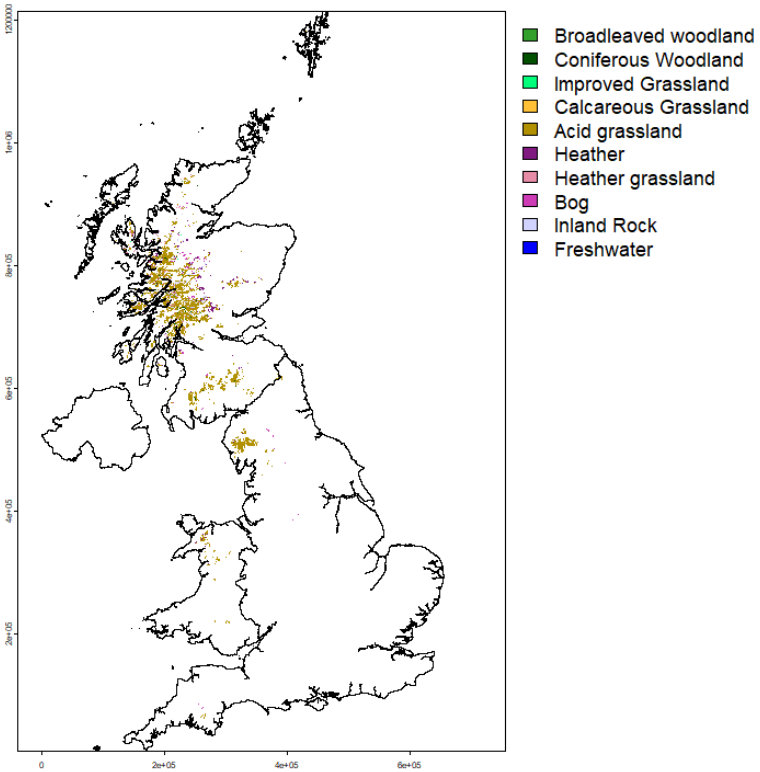

Figure 36 Land cover map categories at locations of Archetype 8

Archetype 9: Intensive and valley/floodplain arable on chalk/clay soils in England

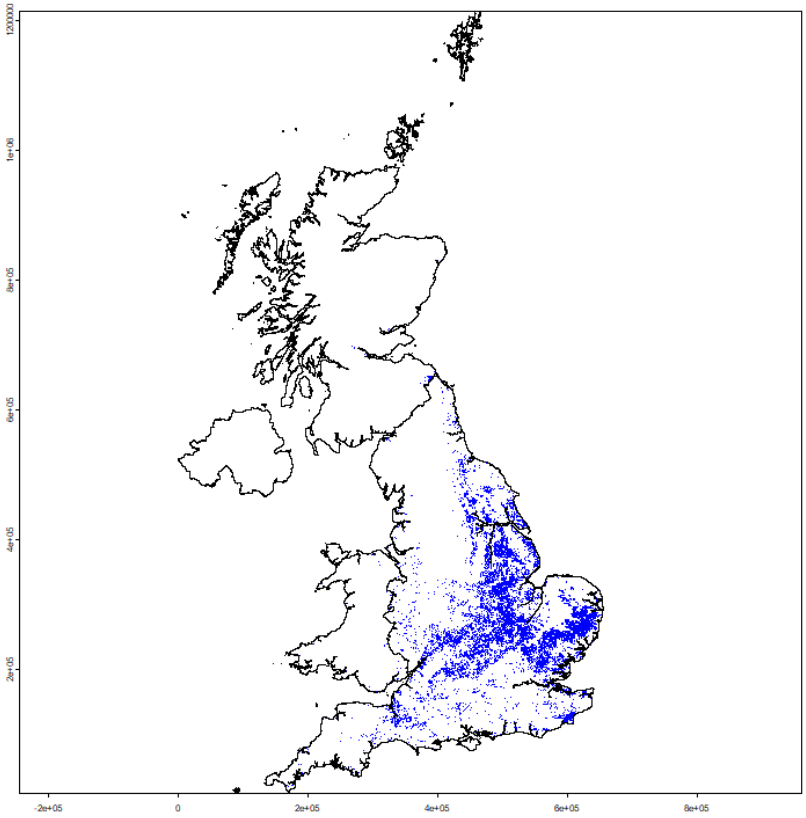

Figure 37 Locations of Archetype 9: Intensive and valley/floodplain arable on chalk/clay soils in England

Figure 38 Archetype 9 representative photos, Eastern England.

Shortlist: Yes. Covers a large proportions of land area in England and is a distinct land use and soil type combination from other archetypes.

Source: Goodwin *et al*. (2022) Tier 2 archetype number 10 (Intensive arable in clay/chalk vales), with any degraded lowland or upland organic soil locations assigned to Archetypes 1 and 2 (around 1% of this land was assigned to the organic soil archetypes). Then combined with any locations from Goodwin *et al*. (2022) Tier 1 archetype number 6 (Valley/floodplain arable on clay loam) not already located in Archetypes 1-7.
Area: 2,172,600 ha (21,726 km^2)
Coverage of land area: England 16%, Scotland <1%, Wales 1%
Spatial scale: Landscape scale – mostly in a broad, relatively well-defined area of eastern and central England

Emissions in 2021: LULUCF 0.3 t CO_2e/ha, Agriculture 2.1 t CO_2e/ha

Description

- Located mainly in eastern and central England
- Clay and alkaline soils, relatively dry climate and relatively flat land
- Arable land (80%) with some improved grassland (18%) across central England (Figure 39, Table 3)
- Used for large-scale (large fields)[11] arable growing, pigs and poultry; some horses.

[11] From the Goodwin *et al.* (2022) archetypes it only shows that these fields are larger than average. However, according to DEFRA, in the East of England the average farm size in 2021 was 123 hectares compared to the English average of 85 hectares. https://www.gov.uk/government/statistics/agricultural-facts-england-regional-profiles/agricultural-facts-east-of-england-region#:~:text=In%20the%20East%20of%20England,English%20average%20of%2085%20hectares.

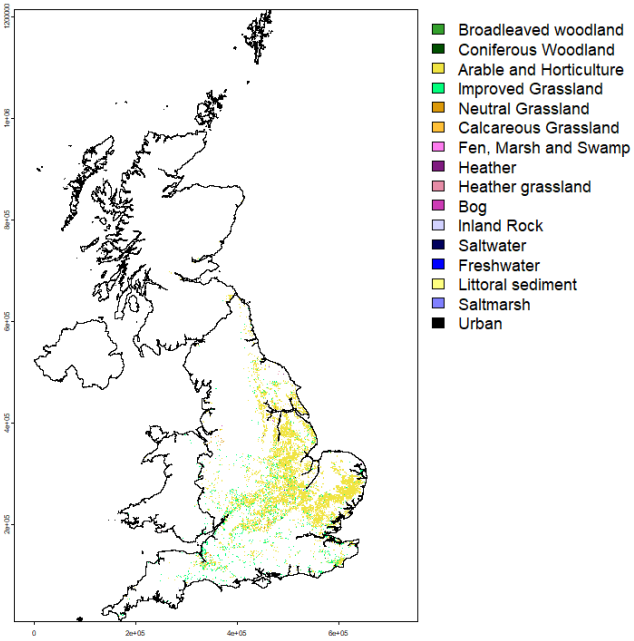

Figure 39 Land cover map categories at locations of Archetype 9

Archetype 10: Arable on sandy soils in England and Scotland

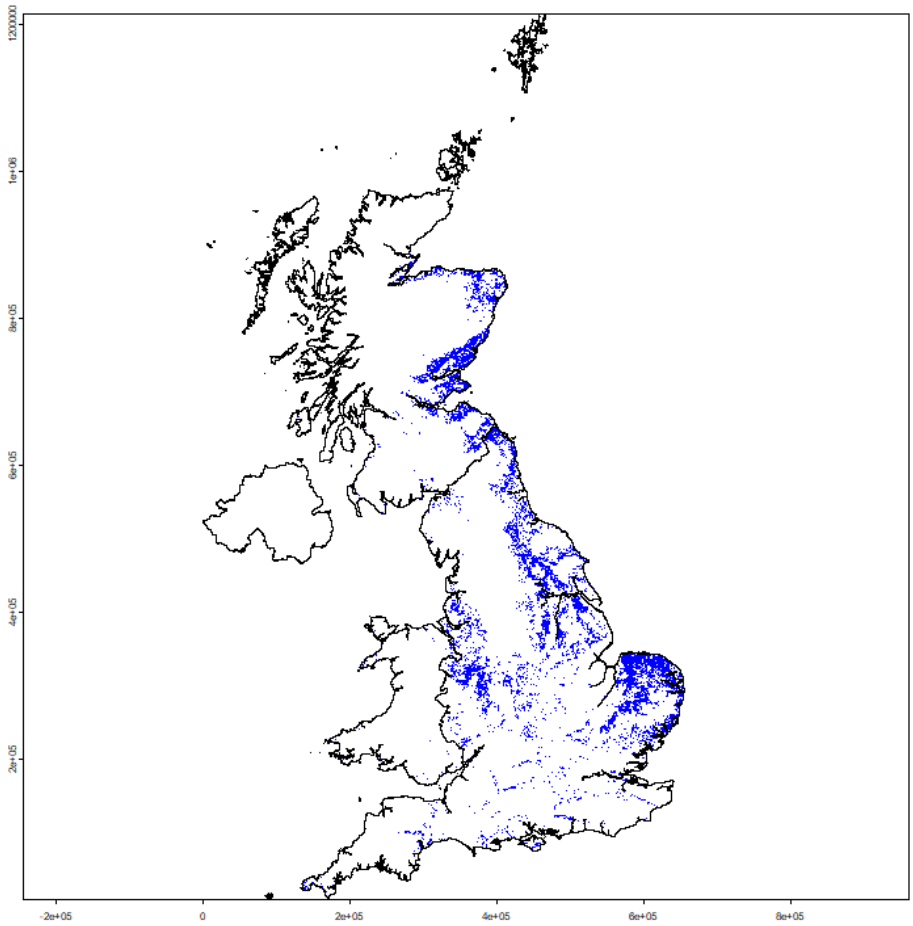

Figure 40 Locations of Archetype 10: Arable on sandy soils in England and Scotland

Figure 41 Archetype 10 representative photos. Left: Aberdeenshire, Scotland; Centre and Right: Suffolk, England.

Shortlist: Yes. Covers a large proportion of land area in England and Scotland and is a distinct land use and soil type combination from other archetypes.

Source: Goodwin et al. (2022) Tier 1 archetype number 16 (Arable with sandy soils), with locations already assigned to the organic soil archetypes (1 and 2), which is about 3% of the original area, or Archetypes 3-9, which is about 10% of the original area, removed.
Area: 2,027,400 ha (20,274km^2)
Coverage of land area: England 12%, Scotland 6%, Wales 1%
Spatial scale: Landscape scale – mostly located in broad, well-defined areas of eastern GB and west England, however also more scattered locations in central England

Emissions in 2021: LULUCF 0.5 t CO_2e/ha, Agriculture 2.1 t CO_2e/ha

Description

- Located mainly East coast of Scotland, across much of England, in particular East Anglia
- Sandy soils
- Mostly arable and horticulture (87%) with some improved grassland (10%) (Figure 42, Table 3)

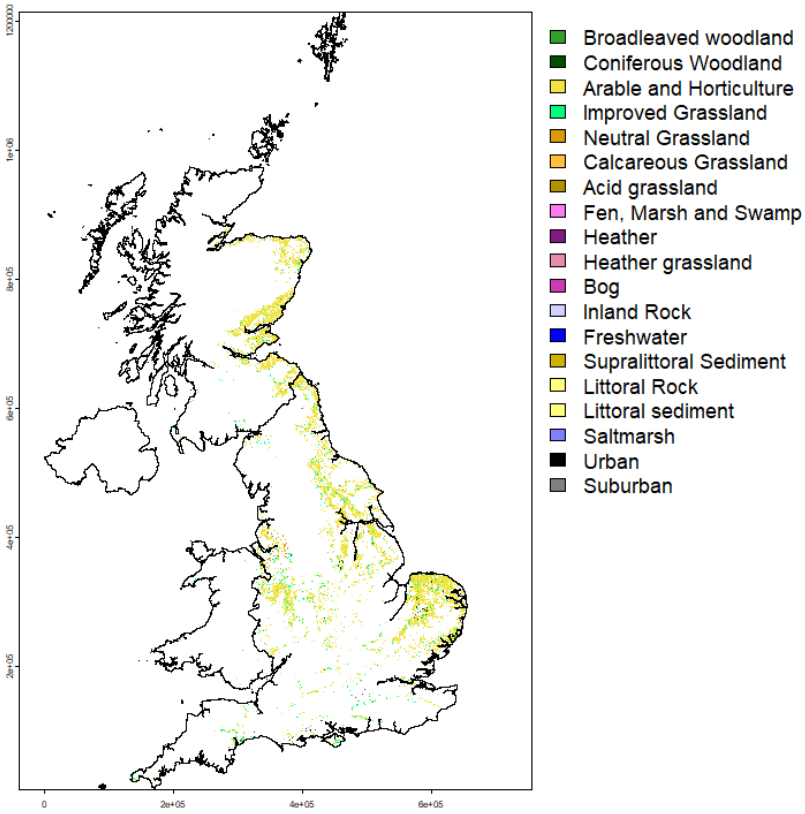

Figure 42 Land cover map at locations of Archetype 10

Archetype 11: Lowland agriculture around Lough Neagh, Northern Ireland

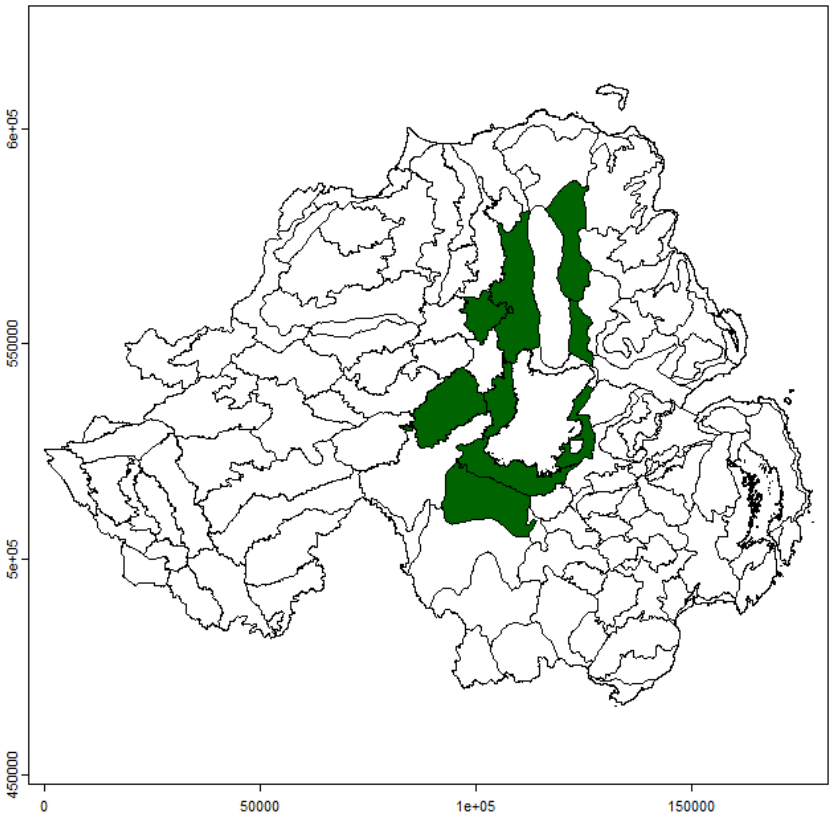

Figure 43 Locations of Archetype 11: Lowland agriculture around Lough Neagh, Northern Ireland

Figure 44 Archetype 11 representative photos

Shortlist: Yes. Although the archetype is relatively small, it has a distinctive nature and is different from other archetypes in GB. There are a range of potential future management options on the agricultural and degraded areas of lowland peat.

Source: The NI Landscape Character Areas described in Table 5.

Table 5: Landscape Character Areas making up Archetype 11

NI Regional Landscape Character Areas	NI Local Landscape Character Areas*	
11. West Lough Neagh Drumlins	42	Cookstown Farmlands
	50	Moyola Floodplain
	52	Lower Bann Valley (part)
13 Southern Drumlins and Orchards	47	Loughgall Orchard Belt
14 Lough Neagh Basin	48	West Lough Neagh Shores
	62	East Lough Neagh Points
	64	Lough Neagh Peatlands
15 Lower Bann Valley	52	Lower Bann Valley (part)
	59	Cullybackey and Clogh Mills Drumlins
	60	River Main Valley

- LCA 61 (North Lough Neagh Shores), 49 (Magherafelt Farmland) and 63 (Portmore Lough Fringe) were also assessed but excluded because of a lack of peat soils. LCA 58 has been excluded because it is more upland in nature with blanket bog rather than lowland raised bog peat types.

Area: The component LCAs cover 128,800 ha (1,228 km^2)
Coverage of land area: 9% of Northern Ireland.
Spatial scale: Landscape-scale, consisting of the lowlands around Lough Neagh.

Emissions in 2021: LULUCF 1.3 t CO_2e/ha, Agriculture 5.0 t CO_2e/ha

Description:

- Mostly improved grassland (85%), with smaller areas of neutral grassland (5%), freshwater (5%) and suburban land (3%) (Figure 45, Table 3).
- Beef and dairy farming, orchard and some arable production in the south, lamb and (large-scale) poultry production around Lough Neagh.
- The landscape is characterised by drumlins[12] or gently rolling low hills with areas of wetland semi-natural habitat around the rivers and loughs.
- Hedgerow density varies across the area, with sparse hedges in the west but dense hedgerows in the south.
- The south of the area is the only part of Northern Ireland where orchards occur in such concentration.

[12] Drumlins are elongated small hills in the shape of an inverted spoon or half-buried egg formed by glacial ice acting on underlying unconsolidated till. They often occur together in fields or 'swarms'.

- Lowland raised bog previously covered much of the archetype area, but has been cut-over, drained or reverted to semi-natural habitats. There is ongoing peat extraction for fuel and horticultural use and small areas of intact lowland raised bog peat.

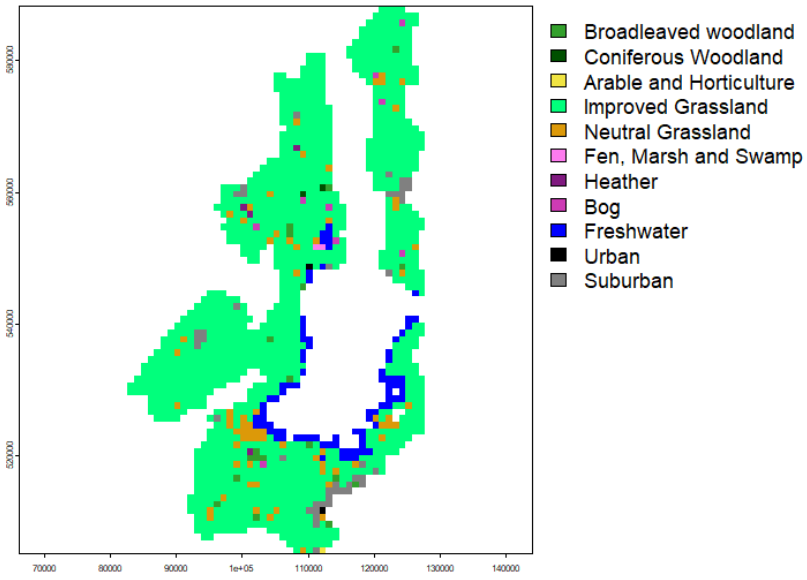

Figure 45 Land Cover map at locations of Archetype 11

Archetype 12: Uplands with large extent on organic soils in Northern Ireland

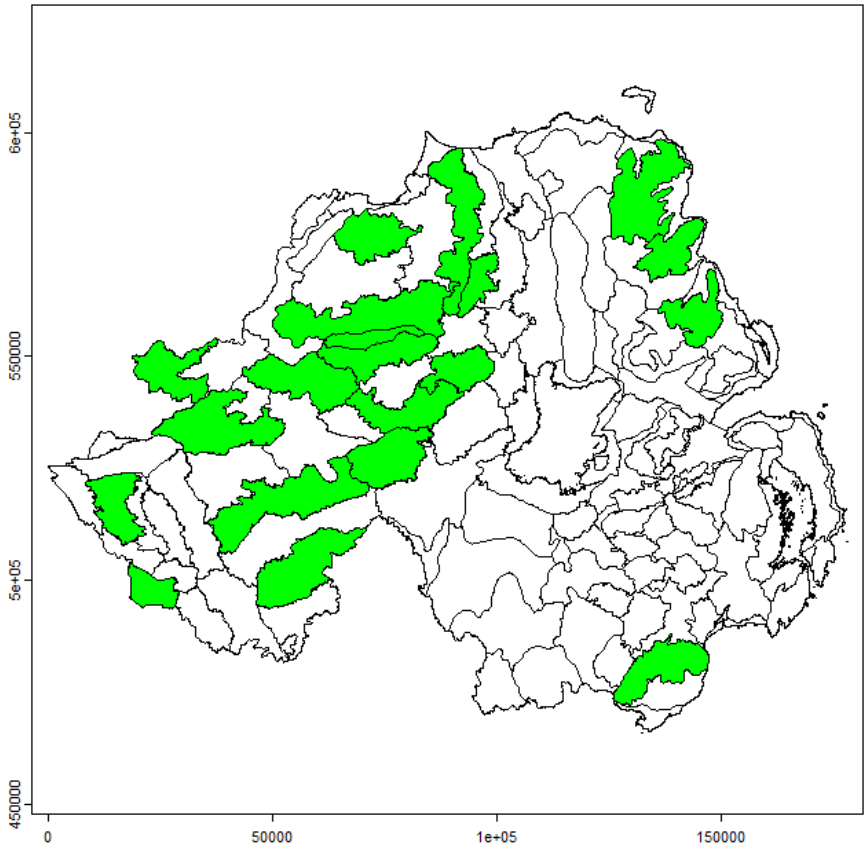

Figure 46 Northern Ireland Landscape Character areas in the Uplands with a large extent on organic soils archetype

Figure 47 Archetype 12 representative photos

Shortlist: Yes. Although this archetype is comparable to Archetype 1 in GB there is a much greater extent of bog that has been cut-over for domestic peat extraction.
Source: The NI Landscape Character Areas described in Table 6Table 5.

Table 6: Landscape Character Areas making up Archetype 12

NI Regional Landscape Character Areas	NI Local Landscape Character Areas	
1 Fermanagh Caveland	4	The Lough Navar and Ballintempo Uplands
	9	Cuilcagh and Marlbank
2 Loch Erne Lakeland	14	Lough Bradan (part)
	16	Brougher Mountain (part)
3 Clougher Valley and Slieve Beagh	18	Slieve Beagh
	16	Brougher Mountain (part)
5 West Tyrone Hills and Valleys	19	Killeter Uplands
	14	Lough Bradan (part)
7 Sperrins	24	South Sperrin
	26	Bessy Bell and Gortin
	28	Glenelly Valley
	29	Sperrin Mountains
	39	Glenshane Slopes
	41	Slieve Gallion (part)
8 North Sperrin Hills and Valleys	34	Loughermore Hills
10 Binevenagh Ridge	36	Binevenagh
12 Carrickmore Plateau and Pomeroy Hills	43	Carrickmore Hills
	44	Slievemore
	41	Slieve Gallion (part)
18 Antrim Plateau and Glens	118	Moyle Moorlands and forest
	122	Garron Plateau
	124	Larne Basalt Moorland
25 Mourne and Slieve Croob	75	Mourne Mountains

Area: The component LCAs cover 321,800 ha (3,218 km^2)
Coverage of land area: 22% of Northern Ireland.
Spatial scale: Landscape-scale, consisting of the uplands predominantly in the west of Northern Ireland, with small areas on the north-eastern coast and in the south-east.

Emissions in 2021: LULUCF 1.8 t CO_2e/ha, Agriculture 3.9 t CO_2e/ha

Description:

- A combination of improved grassland (41%), Bog (19%), Acid grassland (15%) and Coniferous woodland (13%), with smaller areas of Broadleaved woodland, Neutral grassland, Calcareous grassland, Heather and Heather grassland (Figure 48, Table 3).
- Dairy and beef cattle farming, sheep farming.
- In the lower farmed areas there are hedges but these vary in density. Where field boundaries exist (on the valley bottoms and slopes), the fields are generally small.
- There is peat extraction for fuel and horticulture, with large scale peat cutting in some moorland areas and subsequent erosion but large areas of blanket bog are still intact.

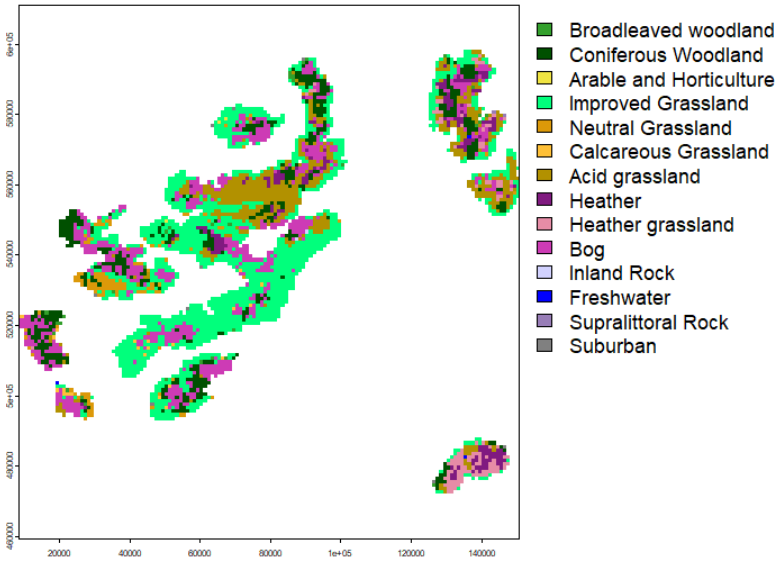

Figure 48 Land Cover Map at locations of Archetype 12

Archetype 13: Managed conifer on acidic, organic soils

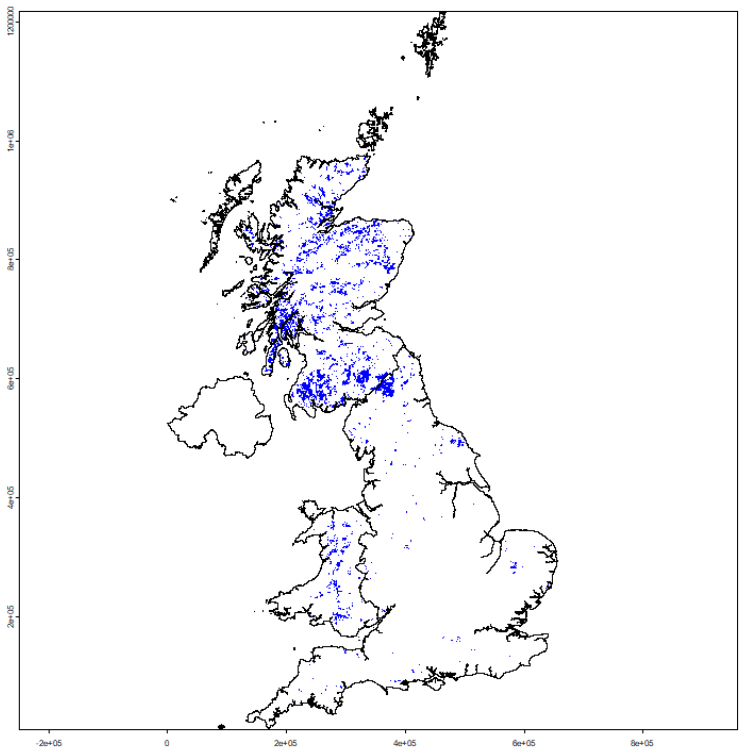

Figure 49 Archetype 13: Managed conifer on acidic, organic soils

Figure 50 Archetype 13 representative photos. Left: Kielder Forest, England. Right: Argyll and Bute, Scotland.

Shortlist: No – As forest cannot change land-use (except in the case of peatland habitat restoration captured under Archetype 2), there is a lack of future management options for further investigation. This is an archetype that others may transition to (on acidic soils). Around a quarter of the area of this archetype is located on organic soils. As this archetype is not shortlisted, this area will be captured in the Degraded upland organic soils archetype (2) which is shortlisted.

Source: Goodwin et al. (2022) Tier 1 archetype number 2 (Forest on acidic, organic soils)
Area: 1,257,500ha (12,575km^2)
Coverage of land area: England 1%, Scotland 13%, Wales 5%
Spatial scale: Landscape/smaller scale – Fairly scattered locations but generally clustered in patches

Description

- Located mainly across Scotland, with smaller areas in Wales and England
- Acidic and organic soils
- Relatively wet and cool climate
- Mostly conifer forest (89%) managed for timber production with a small area of broadleaved woodland (5%) and acid grassland (2%) (Figure 51)

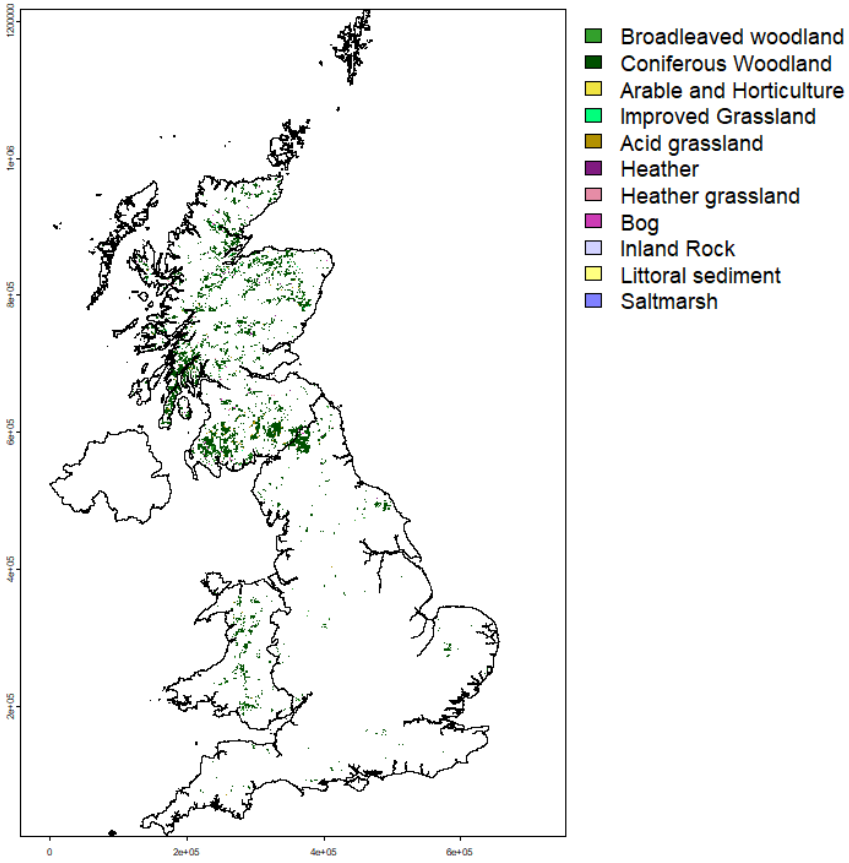

Figure 51 Land Cover Map data at locations of Archetype 13

Archetype 14: Non-managed lowland broadleaf

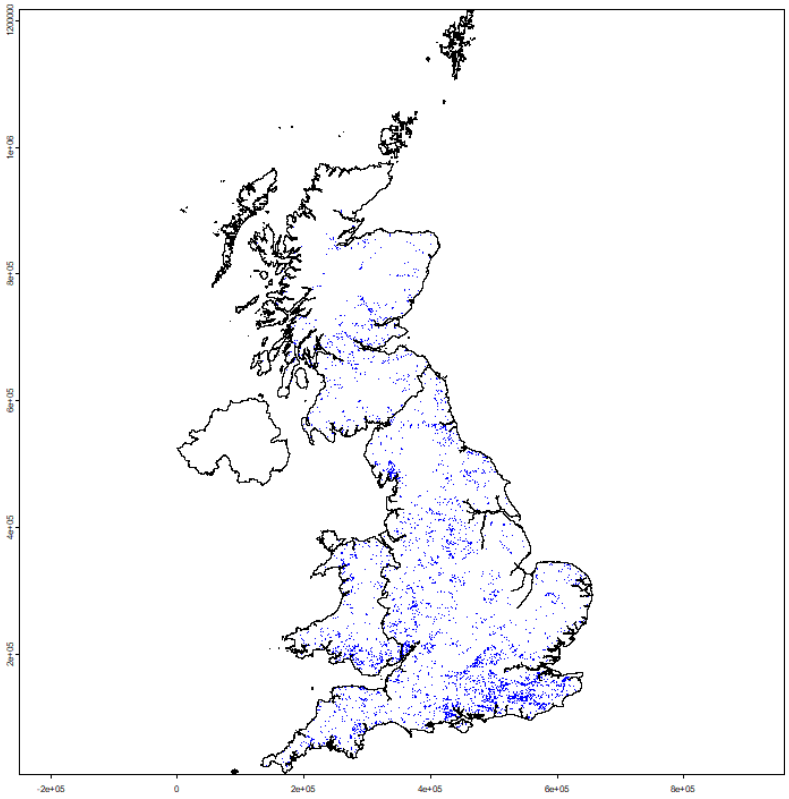

Figure 52 Locations of archetype 14: Non-managed lowland broadleaf

Figure 53 Archetype 14 representative photos. Left: Southern England. Right: Forest of Dean, England

Shortlist: No
This archetype is distinct in location from the other archetypes, overlapping with the organic soils archetypes (1 and 2) with around 2% of its total area, and not overlapping with any of the other GB archetypes.
However, it is not shortlisted as forest cannot change land-use, creating a paucity of future management options. Although the CCC recommended increased broadleaf woodland management in the 6th Carbon Budget recommendations; this is anticipated to have a very small impact on greenhouse gas emissions before 2050. This is an archetype other archetypes may transition to.

Source: Goodwin et al. (2022) Tier 1 archetype number 13 (Broadleaf woodland)
Area: 1,250,700 ha (12507km^2)
Coverage of land area: England 7%, Scotland 3%, Wales 7%
Spatial scale: Scattered locations throughout GB

Description

- Located across much of England, Wales and Scotland
- The largest area of land cover in this archetype is broadleaf woodland (48%), however there is also a high proportion of improved grassland (33%) and arable and horticulture (10%). (Figure 54) due to the machine learning methodology used in the source dataset.

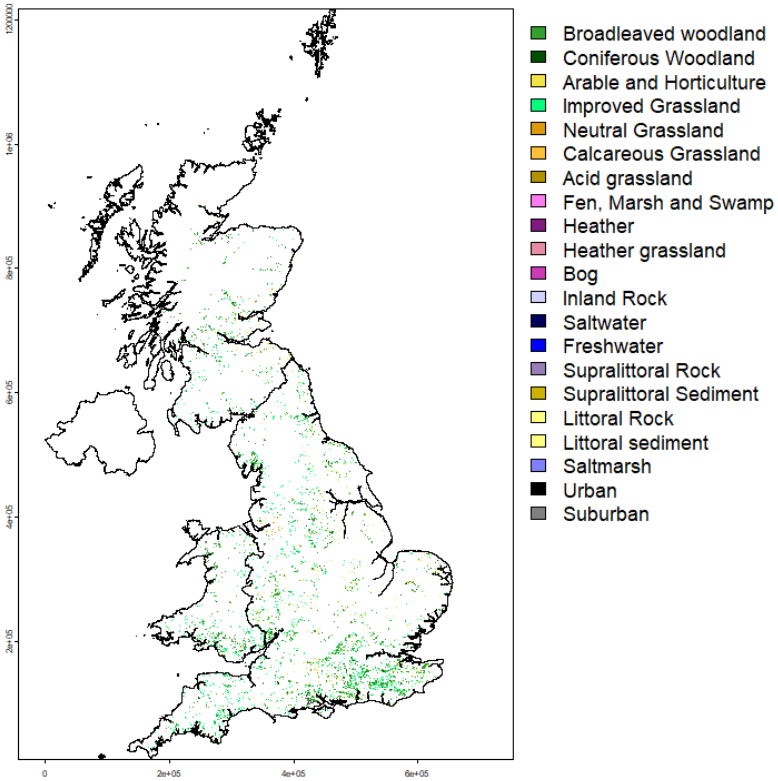

Figure 54 Land Cover Map at Archetype 14 locations

Archetype 15: Non-managed native trees upland

Shortlist: No – This is an archetype others may transition to
The existing area of non-managed native trees in uplands is very fragmented, with areas generally being small (estimated <100 ha) and difficult to derive from available datasets. This archetype has not been taken forward for now.

Figure 55 Archetype 15 representative photos, Scotland

Archetype 16: Horticulture on organic soils in England

Figure 56 Archetype 16 representative photos, The Fens, England

Shortlist: No
While there are specific management options that can be applied to horticulture on organic soils, this area is captured within Archetype 1: Highly degraded lowland organic soils in GB and so these options can be considered with that archetype.

Area:
Figure 57 shows the area of cropland from the Clilverd et al. (2023) peat condition maps. This area is a total of 1,993 km^2 and covers 1.5% of the land area of England, and <1% of the land area of Scotland and Wales. This area includes all cropland on organic soil and so to further refine area to horticultural land, a dataset such as the UKCEH Land Cover plus: Crops could be used to identify locations used for horticultural crops.

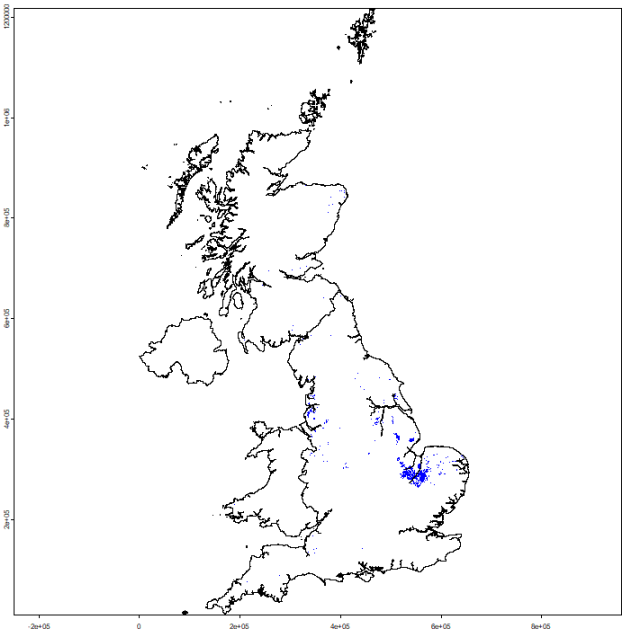

Figure 57 Area of cropland on organic soils

Archetype 17: Open farmland on sandy soils in Scotland

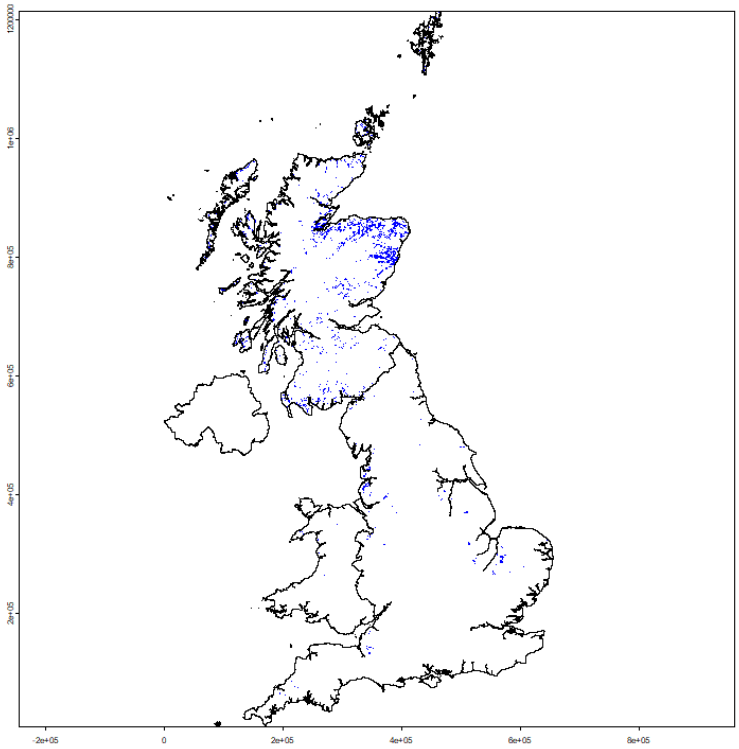

Figure 58 Locations of Archetype 17: Open farmland on sandy soils in Scotland

Figure 59 Archetype 17 representative photos. Left: Aberdeenshire, Scotland. Right: Scotland.

Shortlist: No – This archetype covers a relatively small area and around 20% of this area is captured in the organic soils archetypes (1 and 2).

Source: Goodwin et al. (2022) Tier 2 archetype number 1 (Open farmland on light, sandy soils)
Area: 549,400 ha (5,494km^2)
Coverage: England 0%, Scotland 6%, Wales 0%
Spatial scale: Farm scale – scattered locations although mostly clustered around NE Scotland

Description

- Mostly located in Northeast Scotland, also southern Scotland and small areas across England
- Sandy soils, some parts on organic soils, with a relatively wet climate
- Mostly improved grassland (66%), with smaller areas of arable and horticultural land (13%), broadleaved woodland (7%) and other types of grassland (Figure 60, Table 3).
- Few hedgerows dividing up fields.

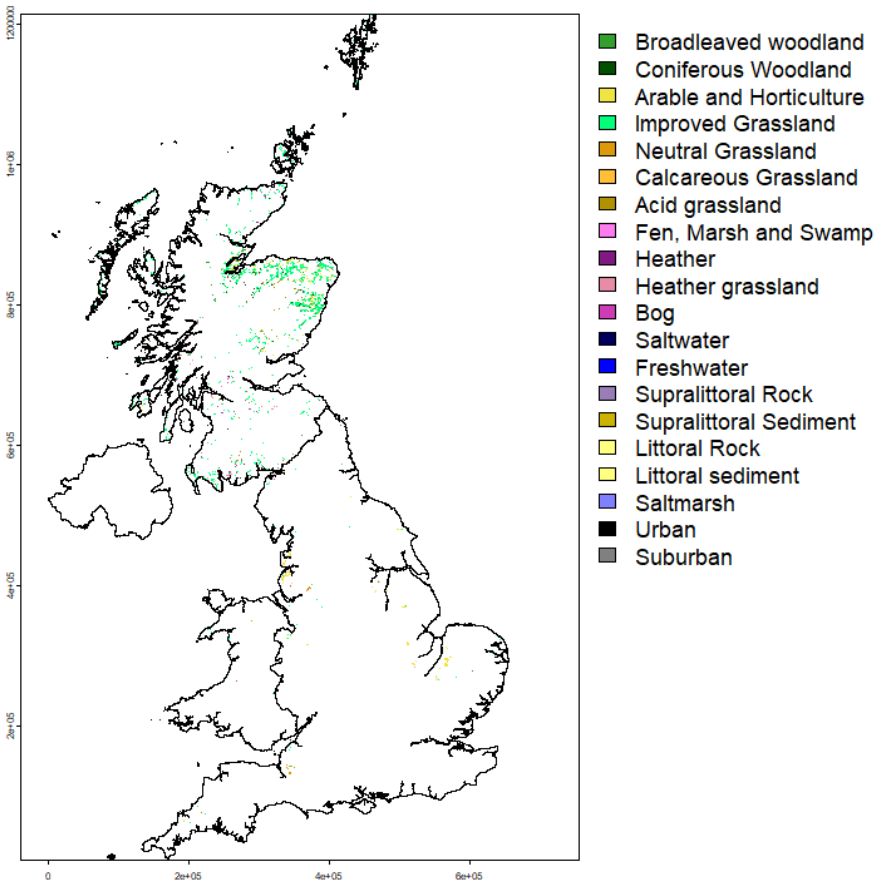

Figure 60 Land Cover Map data at locations of Archetype 17

Archetype 18: Valley/floodplain arable on clay loam in England

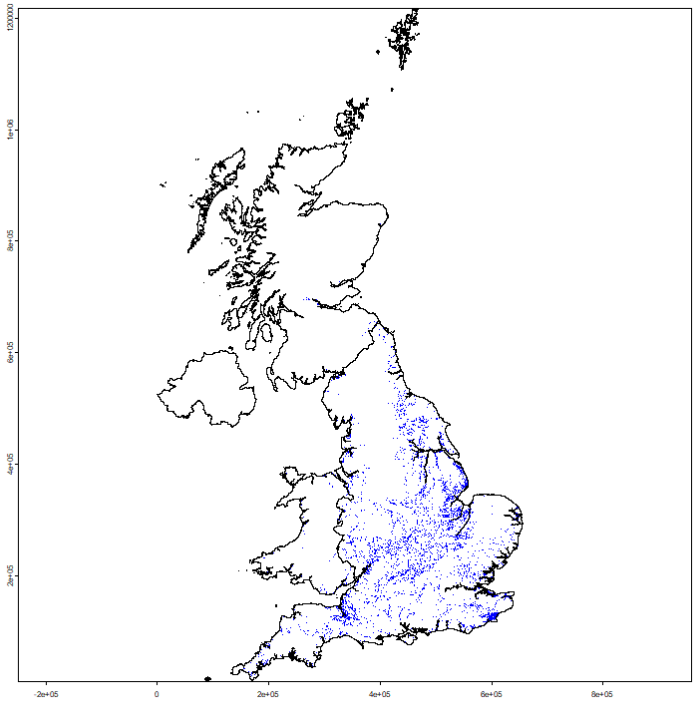

Figure 61 Locations of Archetype 20: Valley/floodplain arable on clay loam in England

Figure 62 Archetype 18 representative photos. Left: Eastern England; Right: Southern England.

Shortlist: While originally considered as a separate archetype, this archetype contains small areas overlapping with other archetypes on the shortlist. It has been combined with Goodwin et al. (2022) Tier 2 archetype number 10 (Intensive arable in clay/chalk vales) to form Archetype 9 in the shortlist, as these represent similar types of farming in similar areas and on similar soils.

Source: Goodwin et al. (2022) Tier 1 archetype number 6 (Valley/floodplain arable on clay loam)
Area: 1,155,700 ha (11,557km^2)
Coverage of land area: England 9%, Scotland 0%, Wales 1%
Spatial scale: Farm scale – scattered locations across England, mixed in with other archetypes

Description

- Located across England, particularly East, Central and South
- Clay soils, flat lowlands, relatively warm and dry climate, near to watercourses
- Land uses mostly arable/horticulture (56%) and improved grassland (36%) (Figure 63, Table 3)

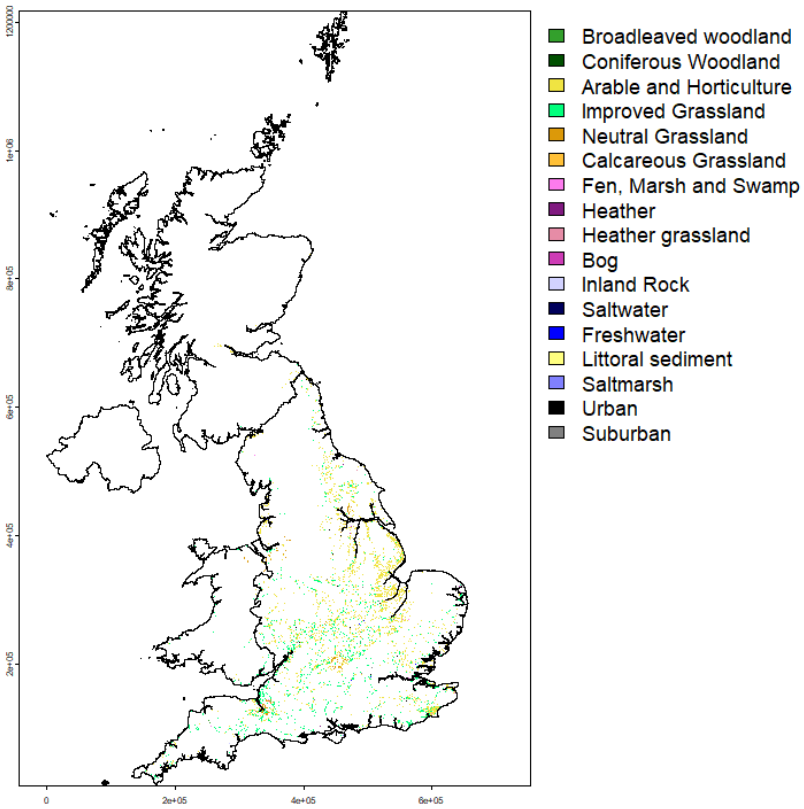

Figure 63 Land Cover Map at locations of Archetype 18

Archetype 19: Improved grassland on mineral soil in Northern Ireland

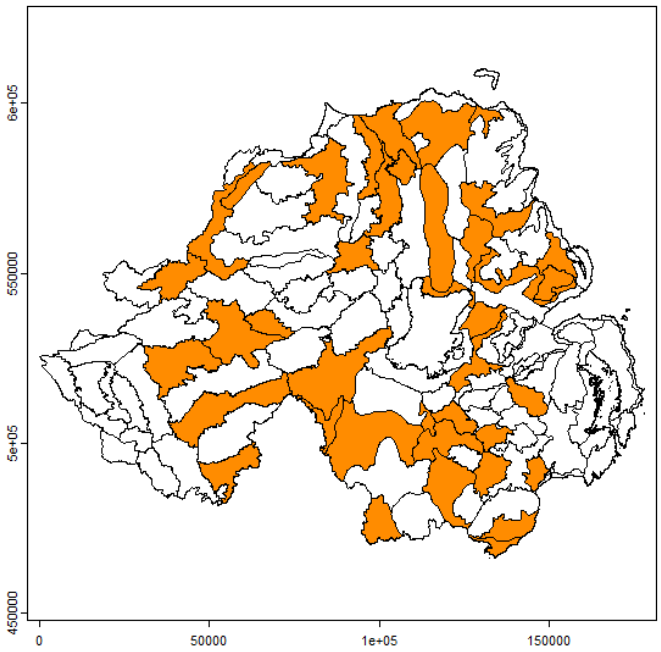

Figure 64 Locations of Archetype 19: Improved grassland on mineral soil in Northern Ireland

Shortlist: No. This archetype is typical of much of the lowland agricultural area in Northern Ireland, being dominated by improved grassland for livestock grazing. It is very similar to the shortlisted Archetypes 3 and 6 in Great Britain, with the same future management options. It is also similar to Archetype 11, but without the degraded lowland organic soils.

Source: The NI Landscape Character Areas described in Table 7

Table 7: The Landscape Character Areas making up Archetype 19

NI Regional Landscape Character Areas	NI Local Landscape Character Areas*	
2 Lough Erne Lakeland	15	Irvinestown Farmland
3 Clogher Valley and Slieve Beagh	12	Newtownbutler and Rosslea Lowlands
	17	Clogher Valley Lowlands
4 Omagh Basin	22	Omagh Farmland
	23	Camowen Valley
5 West Tyrone Hills and Valleys	20	Derg Valley
6 Foyle Valley	27	Foyle Valley
	31	Burngibbagh and Drumahoe
7 Sperrins	40	Upper Moyola Valley
8 North Sperrin Hills and Valleys	37	Roe Basin
10 Binevenagh Ridge	38	Eastern Binevagh Slopes

13 Southern drumlins and orchards	45	Dungannon Drumlins and Hills
	46	Blackwater Valley
	66	Armagh Drumlins
14 Lough Neagh Basin	61	North Lough Neagh Shores
	109	Upper Ballinderry Plateau
	113	Expansive Crumlin Farmland
15 Lower Bann Valley	51	Garvagh Farmland
	53	Lower Bann Floodplain
16 North Coast and Rathlin Island	54	Coleraine Farmlan
	56	Dervlock Farmlands
	119	Ballycastle Glens
17 Maine and Braid River Valleys	116	Ballymena Farmland
	117	Central Ballymena Glens
19 South Antrim Hills and Six Mile Water	98	Carrickfergus Upland Pastures
	115	Tardree and Six Mile Water Slopes
	127	Larne Ridgeland
20 Belfast Lough and Islandmagee	130	Carrickfergus Farmed Escarpment
22 Down Drumlins and Holywood Hills	90	Ravarnet Valley
23 Newry Valley and Upper Bann	65	Upper Bann Floodplain
	67	Armagh / Banbridge Hills
	69	Newry Basin
	78	North Banbridge Hills
24 Slieve Gullion and South Armagh Hills	70	Crossmaglen Drumlins and Loughs
25 Mourne and Slieve Croob	73	Kilkeel Coast
	74	Kingdom Of Mourne
	76	Ballyroney Basin
	83	Lower Slieve Croob Foothils
	85	Newcastle Valleys

Area: 484,200 ha (4,842 km^2)
Coverage of land area: 35% of Northern Ireland
Spatial scale: Landscape-scale, consisting of the lowlands in much of inland Northern Ireland.

Description:

- Dominant land cover is improved grassland (86%), with smaller areas of suburban (4%), neutral grassland (3%) and bog (2%) (Figure 65)
- Agricultural usage is livestock grazing (dairy, beef and sheep).

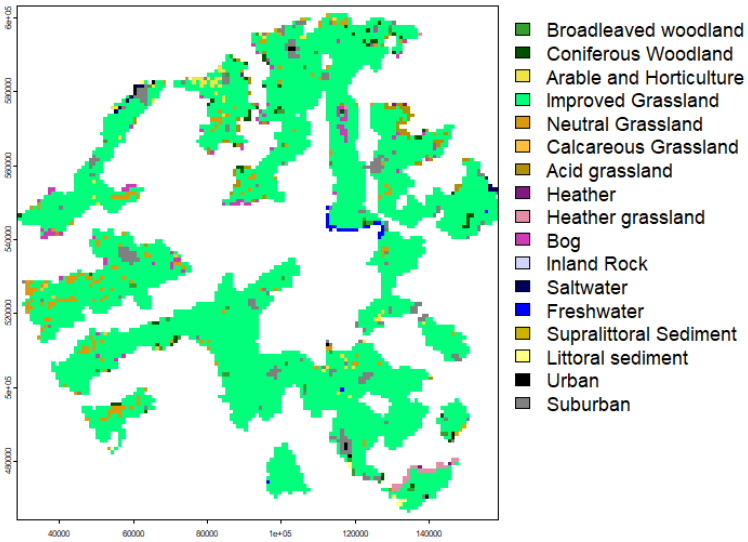

Figure 65 Land Cover Map at locations of Archetype 19

Archetype 20: Lowland agriculture in south-east Northern Ireland

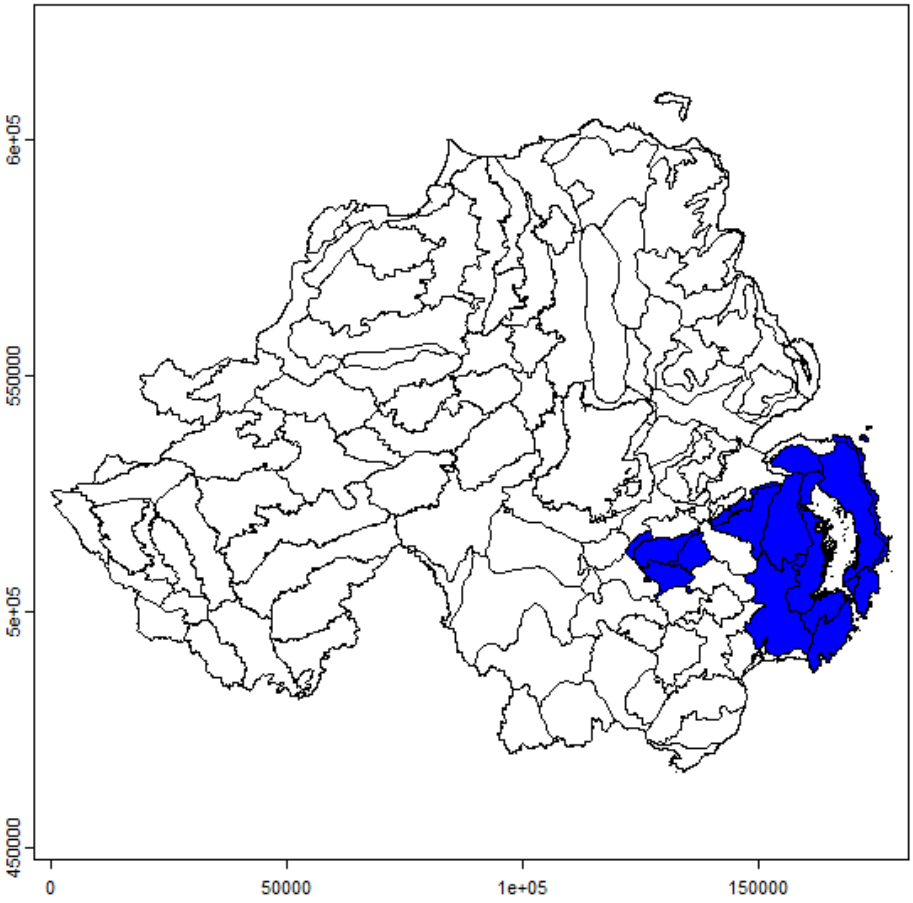

Figure 66 Location of Archetype 20: Lowland agriculture in south-east Northern Ireland

Shortlist: No. This archetype was included in the long-list as it represents more mixed agricultural lowland in south-eastern Northern Ireland. However, its area is small and it is similar to Archetypes 4 and 7 in Great Britain, with the same future management options.

Source: The NI Landscape Character Areas described in Table 8

Area: 103,700 ha (1037 km^2),
Coverage of land area: 7.5% of Northern Ireland.
Spatial scale: Landscape-scale, consisting of the lowlands to the east and south-east of Belfast in County Down. This area has the greatest level of arable production in Northern Ireland, but for the most part retains its patchwork of small fields with arable and pasture interspersed.

Table 9: The Landscape Character Areas making up Archetype 20

NI Regional Landscape Character Areas	NI Local Landscape Character Areas*	
22 Down Drumlins and Holywood Hills	80	Donaghcloney Valley
	81	Kilwarlin Plateau
	82	Dromore Lowlands
	89	Hillsborough Slopes
	95	Ballygowan Drumlins
	96	Castlereagh Plateau
	102	Holywood Hills
	105	Castlereagh Slopes
26 Strangford, Ards and Lecale	91	Quoile Valley
	92	Ballyquintin and Lecale Coast
	93	Portaferry and North Lecale
	94	Strangford Drumlins and Islands
	99	Outer Ards Coast
	100	Ards Farmlands and Estates
	101	Scrabo

Description:

- This archetype is lowland agriculture dominated by improved grassland and with higher coverage of arable (11-25%) than the Northern Ireland average of 6%. The component LCAs either have no peatland coverage or small fragments of cut-over raised bog.
- Predominantly improved grassland (76%) with smaller areas of arable and horticulture (6%), saltwater (6%) and suburban land (5%) (Figure 67, Table 3). The Land Cover Map analysis gives a smaller area of arable and horticultural land is lower than in the description from the LCA, however this is likely to be due to the Land Cover Map showing the dominant land cover on a 1km grid, and arable land typically being smaller areas than this in south-east NI.
- Farmland has hedge boundaries in generally good condition.

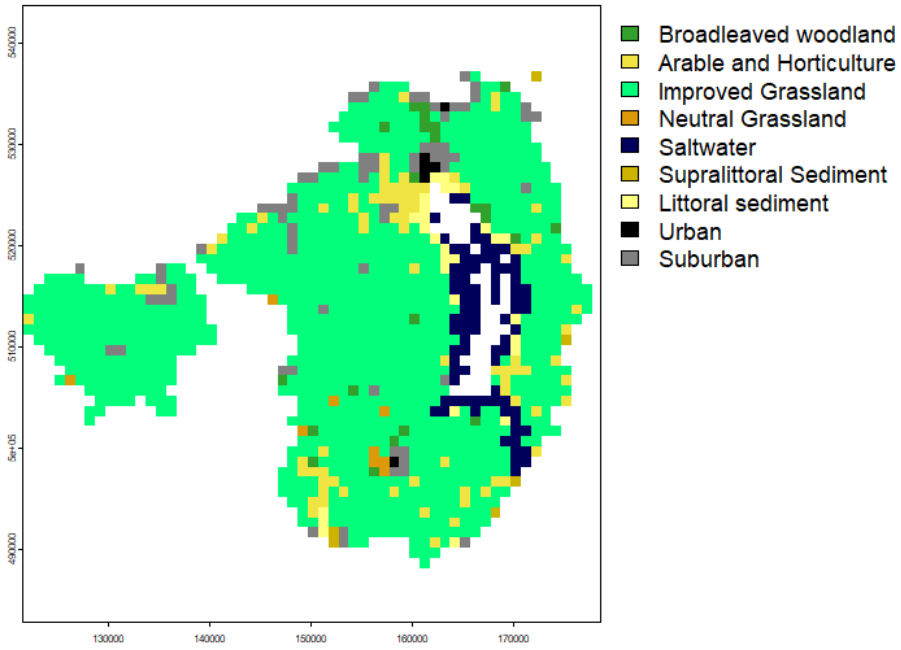

Figure 67 Land Cover Map at locations of Archetype 20

5. Conclusions

The Committee on Climate Change (CCC) want to identify and quantify the impact of plausible land use change/management transitions in rural landscapes on greenhouse gas emissions out to 2035 and 2050. This report documents the initial development of a set of archetypes that are representative of current UK rural land-use and land-management and will act as the baseline for this proposed further work.

A longlist of 20 archetypes was reduced to a shortlist of 12 based on whether archetypes characterised a distinct land use and management combination, covered a substantial area of GB/NI, had options for changing land management in the future.

The twelve short-listed archetypes cover 46% of the land area of the UK (47% of Great Britain and 31% of Northern Ireland). Ten archetypes occur in England, five in Scotland, three in Wales and two in Northern Ireland. These cover a range of agricultural land classes and management types, climate types and soil types.

A high-level assessment of the LULUCF and Agriculture emissions from each archetype showed that 73% of the UK's net LULUCF GHG emissions arose from the short-listed archetype area and 51% of the agricultural emissions. Archetypes dominated by intensive livestock farming or by degraded peatlands had the highest net GHG emissions by area. It should be noted that most of the net sequestration from forest land was not captured by this assessment because archetypes dominated by forest cover were excluded from the shortlist.

A workshop with stakeholders from governmental and non-government organisations was held in June 2023 to present this initial work. This highlighted areas for development in CCC's intended second phase of archetype development including comparison with other landscape character assessment typologies and the assessment of key metrics for each archetype, such as water availability, food production, future risks arising from environmental change, population density and farm size/structure. There was interest in the development of an archetype covering coastal habitats where there are unique factors of sea-level rise and potential blue carbon mitigation in play. It was also suggested that archetypes 11 and 19 in Northern Ireland could be combined into a single, larger archetype.

6. Glossary

Word/phrase	Meaning
Acidic soils	Soils with a pH value of less than 5.5 for most of the year[13]
Acid grassland	Grassland on nutrient-poor, generally free-draining soils with pH ranging from 4 to 5.5 overlying acid rocks or superficial deposits such as sands and gravels. Plant species include grasses and herbs, and some dwarf shrubs may be present.[14]
Archetype	A set of locations that have similar characteristics (here defined in terms of land use and land management), distinct from other locations
Calcareous grassland	Characterised by vegetation dominated by grasses and herbs on shallow, well-drained soils which are rich in bases. Soil pH tends to be high (>6). (Morton et al., 2011)
Chalky soils	Chalky or lime-rich soils are alkaline soils over limestone or chalk
Clay soils	Contain mostly clay particles, which are the smallest soil particles. Highly fertile but poor drainage.[15]
Cut-over bog	Areas previously used for peat extraction
Domestic extraction	Cutting of peat for domestic use (fuel)
Enclosed pasture	Fields typically surrounded by hedgerows
Farm-scale archetype	An archetype where locations appear relatively scattered across GB/a DA, and a farm may be in a different archetype to its neighbouring farms.
Fen, marsh and swamp	Includes fen (peatlands receiving water and nutrients from groundwater and surface run-off, as well as from rainfall), flushes (associated with lateral water movement), springs (associated with with localised upwelling of water), fen meadows and rush pasture (waterlogged soil, either mineral or shallow peat), swamp (characterised by tall emergent vegetation) and reedbeds (i.e. swamps dominated by stands of common reed Phragmites australis). (Morton et al., 2011)
Heather grassland	Part of the UK BAP Priority Habitat Dwarf Shrub Heath, which is split into heather and heather grassland in the Land Cover Map

[13] https://www.fao.org/soils-portal/soil-management/management-of-some-problem-soils/acid-soils/en/#:~:text=Acid%20soils%20are%20those%20that,Dystric%20subgroups%20of%20other%20soils.

[14] https://data.jncc.gov.uk/data/902cafcb-578f-43de-8a99-7143f00d79a2/UKBAP-BAPHabitats-26-LowlandDryAcidGrass.pdf

[15] https://ahdb.org.uk/knowledge-library/characteristics-different-soils

Improved grassland	Characterised by vegetation dominated by a few fast-growing grasses, and also white clover, on fertile, neutral soils. Typically managed as pasture or for silage production. (Morton et al., 2011)
Intensive farming	Farming with typically higher levels of inputs per area
Landscape character assessment	"The process of identifying and describing variation in character of the landscape. LCA documents identify and explain the unique combination of elements and features that make landscapes distinctive by mapping and describing character types and areas. They also show how the landscape is perceived, experienced and valued by people." [16]
Landscape-scale archetype	An archetype where locations appear clearly grouped in a particular part of GB/a DA and neighbouring farms are likely to all be in the same archetype
Lime-rich soils	See Chalky soils
Lowland raised bog	Areas of peat which develop primarily in lowland areas such as the head of estuaries, along river flood-plains and in topographic depressions. Generally found in cool, humid regions of the UK.[17]
Mineral soils	Soils not characterised as organic soils
Neutral grassland	Characterised by vegetation dominated by grasses and herbs on a range of neutral soils usually with a pH of between 4.5 and 6.5. (Morton et all., 2011)
Open pasture/farmland	Land with generally few hedgerows to divide it into fields
Organic soils/peatland	Soils with a high proportion (>40%) of organic carbon. In their natural state, they are characterised by a high water table and sphagnum moss-dominated habitats,
Rough grassland/grazing	Uncultivated permanent grassland, usually on low quality soil
Sandy soils	Contains mostly sand particles, which are large soil particles. Typically good drainage but drought-sensitive. [15]
Semi-natural grassland	Acid, neutral and calcareous grasslands
Silty soils	Contains mostly silt particles, which are smaller than sand but bigger than clay. Typically fertile, fairly well-draining.[15]
Upland blanket bog	Areas of peat that have formed across the landscapes in upland areas where the climate is cool and wet[18]

[16] https://www.gov.uk/guidance/landscape-and-seascape-character-assessments

[17] https://data.jncc.gov.uk/data/aadfff3d-9a67-467a-ac65-45285e123607/UKBAP-BAPHabitats-31-LowlandRaisedBog.pdf

[18] https://naturalengland.blog.gov.uk/2020/11/04/blanket-bogs-a-natural-asset/#_edn1

Upland fringe/margin	The area between generally more intensively managed lowland landscapes and more extensively managed open upland landscapes

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