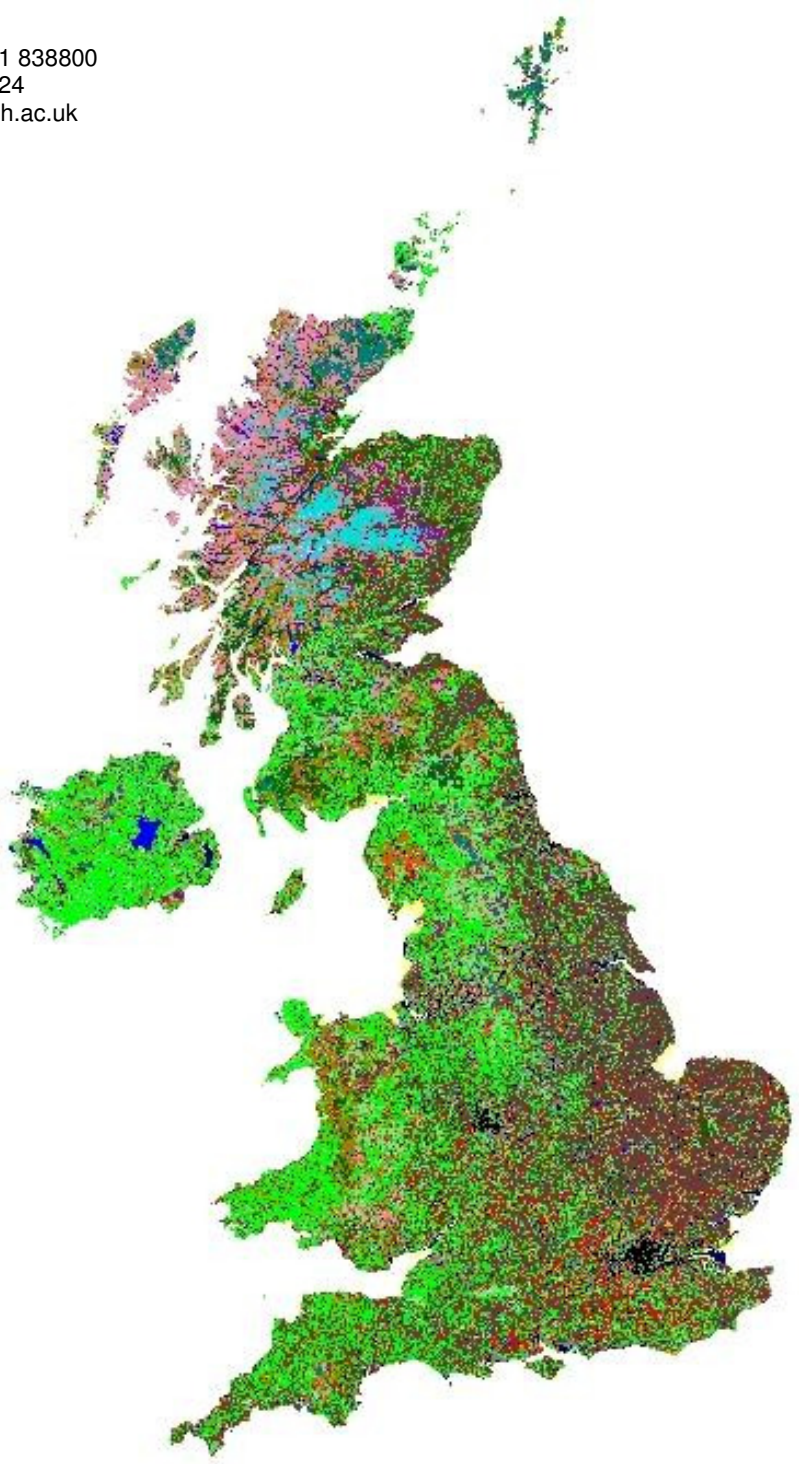
Centre for
Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL
CEH Wallingford, Benson Lane
Wallingford. Oxon
OX10 8BB, UK
Telephone +44 (0)1491 838800
Fax +44 (0)1491 692424
Email spatialdata@ceh.ac.uk
www.ceh.ac.uk



Land Cover Map 2000

Dataset Information

Contents

Introduction

LCM2000 is a parcel-based thematic classification of satellite image data covering the entire United Kingdom. The map updates and substantially upgrades the Land Cover Map of Great Britain (LCMGB) 1990. Like the earlier LCMGB, LCM2000 is derived from a computer classification of satellite scenes obtained mainly from the Landsat sensor, but in addition to LCMGB, it also covers Northern Ireland, producing for the first time an all-UK dataset. It also incorporates information derived from other ancillary datasets. LCM2000 was classified using a hierarchical nomenclature corresponding to the Joint Nature Conservation Committee (JNCC) Broad Habitats, which encompasses the entire range of UK habitats. In addition, it recorded further detail where possible and incorporating land cover classes sought by other users. LCM2000 is produced in both vector and raster formats, with a number of different versions containing varying levels of detail and at different spatial resolutions.

LCM2000 specification

LCM2000 maps land cover; This may be synonymous with land use (e.g. arable crop cover denotes arable land use) but often land use cannot be inferred (e.g. grass used for recreation is much like that which is grazed).

LCM2000 sets a minimum mappable area as >0.5 ha.; Parcels and linear features of 0.5ha and less were dissolved into the surrounding landscape during the production process using spectral or thematic proximity rules. In very limited areas some parcels of less than 0.5 ha may remain due to processing difficulties.

LCM2000 has a classification hierarchy; The Target classes and Subclasses are configured, first, to generate widespread examples of Broad Habitats as defined by the Biodiversity Action Plan and, second, to extend the classification for wider use of the land cover data. Class Variants, if provided, give additional information, but these are not necessarily recognised with the accuracy nor consistency of Target and Subclasses.

Product versions overview

LCM2000 is available in several different product versions, with varying levels of detail and in different data formats, see Table 1.

Table 1. The available product versions

Data format		Detail level		
		Aggregate class level	**Subclass level**	**Variant class level**
		10 classes	26 classes	72 classes
	Vector		Y	Y
	Raster, 25m resolution		Y	
	Raster, 1km resolution	Y	Y	

1. **Vector data format**. This data is provided as polygons (land parcels), with each parcel having a list of attributes attached to it.
   A. **Level 2,** the standard level of detail, which provides 26 LCM2000 Subclasses. This is the most widely used version of the dataset.
   B. **Level 3**, giving class detail down to the 72 Variant level. The quality of this level of detail may vary in different areas of the country, requiring expert interpretation. LEVEL 3 data will only be provided by special arrangement with CEH staff, as more user support will be required.

   The standard vector format is an ESRI shapefile. If using this data within ArcGIS, the Spatial Analyst extension may be required for further data analysis.

2. **Raster data format.** This data has been derived from the Vector database, and is stored as raster dataset at 2 different resolutions.
   A. **25m grid**, consisting of 26 Subclasses.

B. **1km grid**, data derived from the 25m raster dataset and summarised at 2 levels of detail:

- **Subclass level,** provides data from the 26 Subclasses level.
  - **Dominant values,** each pixel provides data on the dominant land cover at a 1km resolution at Subclass level.
  - **Percentage values,** each pixel provides the percentage of a particular land cover within a 1km square at Subclass level.
- **Aggregate class level,** the 26 Subclasses are combined to form 10 simplified Aggregate classes.
  - **Dominant values,** each pixel provides data on the dominant land cover at a 1km resolution at Aggregate class level.
  - **Percentage values,** each pixel provides the percentage of a particular land cover within a 1km square at Aggregate class level.

The standard raster format is a GeoTiff file. If using this data within ArcGIS, the Spatial Analyst extension may be required for further data analysis.

NB. The LCM2000 raster dataset is not directly comparable with the LCM1990 dataset, as it has been constructed by different methods. It is **NOT** suitable for estimating change over the 10-year period.

Vector database details

Dataset coverage

LCM2000 data was compiled on a 100km tile basis. Source images (either summer winter composites or single data images) were classified on a per-parcel basis and the resulting land parcels added to their appropriate 100km tile, see Figure 1.

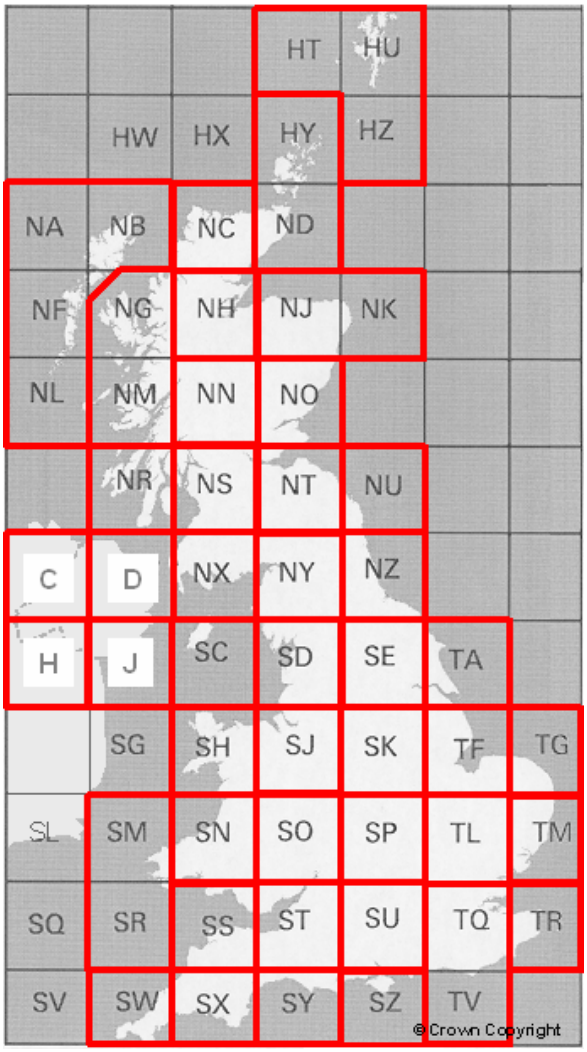


Figure 1. A map of the 100km tiles of the UK showing the areas available in LCM2000. The identifiers highlighted in red represent tiles that were merged to simplify construction.

Hierarchical nomenclature

The vector data is available providing both Subclass and Variant detail. Table 2 shows these detail levels as well as the corresponding attribute code.

Table 2. A table showing the Subclass and Variant codes for each land cover type.

LCM Subclass (Level 2)	Subclass code*	Variants (Level 3)	Alpha-code	Variant code
Broad-leaved / mixed woodland	1.1	deciduous	D	1.1.1
		mixed	Dm	1.1.2
		open birch	Db	1.1.3
		scrub	Ds	1.1.4
Coniferous woodland	2.1	conifers	C	2.1.1
		felled	Cf	2.1.2
		new plantation	Cn	2.1.3
Arable cereals	4.1	barley	Ab	4.1.1
		maize	Am	4.1.2
		oats	Ao	4.1.3
		wheat	Aw	4.1.4
		cereal (spring)	Acs	4.1.5
		cereal (winter)	Aba	4.1.6
Arable horticulture	4.2	arable bare ground	Aba	4.2.1
		carrots	Ac	4.2.2
		field beans	Af	4.2.3
		horticulture	Ah	4.2.4
		linseed	Al	4.2.5
		potatoes	Ap	4.2.6
		peas	Aq	4.2.7
		oilseed rape	Ar	4.2.8
		sugar beet	As	4.2.9
		unknown	Au	4.2.1
		mustard	Ax	4.2.11
		non-cereal (spring)	Ans	4.2.12
Non-rotational horticulture	4.3	orchard	Ado	4.3.1
		arable grass (ley)	Agl	4.3.2
		setaside (bare)	Asb	4.3.3
		setaside (undifferentiated)	Ase	4.3.4
Improved grassland	5.1	intensive	Gi	5.1.1
		grass (hay/silage cut)	Gih	5.1.2
		grazing marsh	Gim	5.1.3
Setaside grassland	5.2	grass setaside	Gis	5.2.1
Neutral grassland	6.1	rough grass (unmanaged)	Grn	6.1.1
		grass (neutral/unimproved)	Gn	6.1.2
Calcareous grassland	7.1	calcareous (managed)	Gc	7.1.1
		calcareous (rough)	Grc	7.1.2
Acid grassland	8.1	acid	Ga	8.1.1
		acid (rough)	Gra	8.1.2
		acid with *Juncus*	Gaj	8.1.3
		acid *Nardus/Festuca/Molina*	Gam	8.1.4
Bracken	9.1	bracken	Gbr	9.1.1
Dense dwarf shrub heath	10.1	dense (ericaceous)	H	10.1.1
		gorse	Hg	10.1.2
Open dwarf shrub heath	10.2	open	Hga	10.2.1
Fen, marsh, swamp	11.1	swamp	Fs	11.1.1
		fen/marsh	Fm	11.1.2
		fen willow	Fw	11.1.3
Bogs (deep peat)	12.1	bog (shrub)	Bh	12.1.1
		bog (grass/shrub)	Bhg	12.1.2
		bog (grass/herb)	Bg	12.1.3
		bog (undifferentiated)	Bo	12.1.4
Water (inland)	13.1	water (inland)	W	13.1.1
Montane habitats	15.1	montane	Z	15.1.1
Inland bare ground	16.1	semi-natural	Ib	16.1.1
		despoiled	Id	16.1.2
Suburban / rural developed	17.1	suburban/rural developed	Us	17.1.1
Continuous urban	17.2	urban residential/commercial	U	17.2.1
		urban industrial	Ui	17.2.2

Supra-littoral rock	18.1	rock	Sr	18.1.1
Supra-littoral sediment	19.1	shingle	Sh	19.1.1
		Shingle (vegetated)	Shv	19.1.2
		dune	Sd	19.1.3
		dune shrubs	Sds	19.1.4
Littoral rock	20.1	rock	Lr	20.1.1
		rock with algae	Lra	20.1.2
Littoral sediment	21.1	mud	Lm	21.1.1
		sand	Ls	21.1.2
		sand with algae	Lsa	21.1.3
Saltmarsh	21.2	saltmarsh	Lsm	21.2.1
		saltmarsh (grazed)	Lsg	21.2.2
Sea / Estuary	22.1	sea	We	22.1.1

*** Note: In some GIS packages the LCM2000 Subclass code is displayed using the data values listed above rather than the Level 2 subclass codes.**

The ability to distinguish land cover at the class Variant level will be dependent upon the dominant land cover at the time of imaging. When, for instance, crops have been harvested, distinctions are neither demanded nor attempted during LCM2000 production. Where possible, contextual information may be have been used to allow class separation, but these records may not be up to date.

Vector polygon attributes

Each vector parcel carries a string of attributes, see Table 3.

Table 3. A table showing the string of attributes present in each land parcel

Attribute	Description	Present in Level 2	Present in Level 3
SegID	Unique identifier code for each segment showing OS 100km square and sequential segment number. e.g. TQ005232 (alphanumeric string).	Y	Y
BHSub	Dominant land cover type for each segment as a hierarchical code. (WidespreadBH.LCMSubclass) e.g. 17.2 (float).	Y	Y
BHSubVar	Dominant land cover type for each segment as a hierarchical code (WidespreadBH.LCMSubclass.Variant).e.g. 17.2.1 (numeric delimited string)	N	Y
PerPixList	Per pixel list by percentage area, of the top five spectral subclasses within the segment e.g.Ab_a,65:Ab_b,20:Aw_c,10:Gi_b,4:Us_c,1 (alphanumeric delimited string) A code list is provided with the dataset.	N	Y
OpHistory	Descriptor detailing the processing history of each segment including image date(s) and numbers of KBC rules applied. e.g.11:4:0:0:0:0 (alphanumeric delimited string) See next page for an explanation of these descriptors.	Y	Y
TotPixels	Total number of pixels within the segment (Integer).	Y	Y
CorePixels	Total number of pixels within the core area of the segment used to perform the maximum likelihood classification. (Integer)	Y	Y

More detailed information on the OpHistory attribute, which contains the processing history for each parcel can be found below.

OpHistory Attribute

The process history descriptor (PHD) is found on each segment. The PHD is made up of five fields containing information about the input data and the various stages of classification, knowledge-based correction (KBC) and final data set compilation. The sixth field covers other information.

Field 1 : 2 : 3 : 4 : 5 : 6

Example 4 : 70 : 0 : 1 : 1 : E

Field number key:

1. **Scene number.** An integer number defining the area, section of the UK, within which the segment was originally classified and had phase 1 KBC applied. This number will identify the input image data (see Table 4) and any scene dependent processing such as KBC and per-pixel attaching. A value of 0 will indicate a segment that has been created and/or labelled outside the standard LCM2000 production flowline, for instance, voids in the data set within lakes that are filled manually, and missing data replaced by LCMGB 1990 data.

Table 4. Table showing the scenes, sensors and image acquisition dates.

Area No.	Sensor		Summer acquisition date	Winter acquisition date	Single date cloud hole patch?
	Summer	Winter			
0					
1	IRS	TM	16/05/98	14/02/98	S
2	TM	TM	30/05/98	14/02/98	
3	IRS	TM	16/05/98	14/02/98	
4	TM	TM	14/05/98	14/02/98	
5	IRS	TM	16/05/98	14/02/98	
6	TM	TM	09/08/98	14/02/98	
7	IRS	TM	16/05/98	14/02/98	
8	TM	TM	30/05/98	14/02/98	
9	TM	TM	30/05/98	12/12/97	
10	IRS	TM	16/05/98	12/12/97	
11	TM	TM	16/05/98	01/11/97	W
12	TM	TM	19/05/98	21/11/96	
13	TM	TM	19/05/98	21/11/96	
14	TM	TM	19/05/98	21/09/97	S
15	TM	TM	19/05/98	03/02/98	
16	TM	TM	19/05/98	21/09/97	S,W
17	TM	TM	19/05/98	28/02/98	
18	IRS	TM	01/05/98	24/07/99	W
19	IRS	TM	20/05/98	03/02/98	S,W
20	TM	TM	19/05/98	23/10/97	S,W
21	IRS	TM	20/05/98	24/07/99	W
22	TM	TM	10/09/99	15/01/97	S.W
23	TM	TM	01/08/99	01/12/97	S,W
24	TM	TM	01/08/99	01/03/97	W
25	TM	TM	30/05/97	25/01/98	
26	IRS	TM	20/05/98	21/10/97	
27	TM	TM	20/05/99	01/05/98	S
28	TM	IRS	30/07/99	07/05/00	S,W
29	TM	TM	30/07/99	16/11/98	S,W
30	TM	TM	29/07/99	12/05/00	S,W
31	TM	TM	30/07/99	05/05/00	S,W,X
32	TM	TM	13/05/00	17/09/99	S,W
33	TM	TM	29/07/99	12/05/00	
34	TM	IRS	01/08/99	04/05/00	S,W
35	TM	TM	12/05/01	21/09/97	S,W
36	TM	IRS	18/05/99	10/05/00	S,W
37	TM	TM	04/06/97	12/05/00	S,W
38	IRS	TM	08/08/00	20/09/00	S,W

Key:

1. **Area number. Where Area number is recorded as 0, this refers to land parcels processed outside the normal production flowline.**
2. **Sensors. TM: Landsat Thematic Mapper, IRS: Indian Remote Sensing satellite.**
3. **Date. The date of image acquisition.**
4. **Single date cloud hole patch?: This refers to the use of only single date images to for part of a scene. For example, where clouds are present in the winter image, only data from the summer image will be used to classify this location. S: some area of this scene is classified from a single date summer image. W: some area of this scene is classified from a single date winter image. X: refers to a one-off classification of a montane area.**

2. **Spectral probability**. An integer number derived from the probability of the top choice spectral subclass (or the sum of the probabilities within the top Broad Habitat if a probability aggregation rule has been applied [see field 3]) multiplied by 100. It gives a summary of how close the spectral information from the segment was to that of a widespread Broad Habitat, but does not indicate accuracy.

3. **Probability aggregation flag**. An integer number to show whether the probability aggregation rule has been applied in phase 1 KBC. A value of 0 signifies that no probability aggregation was applied; a 1 signifies that probability rules were applied.

4. **Phase 1 KBC rules.** An integer number to show the number of phase 1 (scene dependent) KBC rules applied, excluding those related only to re-coding and probability aggregation.

5. **Phase 2 KBC rules.** An integer number of phase 2 (UK wide) KBC rules applied.

6. **A single character flag.** Identifies other situations:
   - E : Eroded during data set merging into 100km squares;
   - G : Grown during data set merging into 100km squares;
   - I : Intertidal data derived from per-pixel classification;
   - H : A void filled manually;
   - K : A segment used to train the classifier;
   - L : Data from LCMGB 1990;
   - Q : A land parcel with questionable quality due to haze in original data;
   - R : Training information 'rolled over' from an adjoining area.

Colour recipes for LCM2000 mapping

Table 5. Table to show the recommended colour display for each of the 26 Subclasses.

LCM Subclass (number & description)	Hue, Saturation, Value			Red, Green, Blue equivalent (approx)		
	H	S	V	R	G	B
1.1 Broad-leaved / mixed woodland	255	255	255	255	0	0
2.1 Coniferous woodland	85	255	101	0	102	2
4.1 Arable cereals	255	255	101	102	61	62
4.2 Arable horticulture	255	255	101	102	61	62
4.3 Arable non-rotational	255	255	101	102	61	62
5.1 Improved grassland	85	255	255	0	255	4
5.2 Setaside grass	29	255	252	255	177	0
6.1 Neutral grassland	85	113	228	127	229	127
7.1 Calcareous grassland	85	113	228	127	229	127
8.1 Acid grassland	36	255	153	153	129	0
9.1 Bracken	12	255	255	255	77	0
10.1 Dense dwarf shrub heath	212	204	127	128	26	128
10.2 Open dwarf shrub heath	242	99	229	230	140	166
11.1 Fen, marsh, swamp	42	255	255	255	255	0
12.1 Bog (deep peat)	123	255	126	0	128	115
13.1 Inland water	170	255	255	0	0	255
15.1 Montane habitats	128	255	255	0	225	225
16.1 Inland bare ground	160	71	254	210	210	255
17.1 Suburban / rural developed	0	3	126	128	128	128
17.2 Continuous urban	0	0	0	0	0	0
18.1 Supra-littoral rock	36	175	202	204	179	0
19.1 Supra-littoral sediment	36	175	202	204	179	0
20.1 Littoral rock	42	127	255	255	255	128
21.1 Littoral sediment	42	127	255	255	255	128
21.2 Saltmarsh	177	123	254	128	128	255
22.1 Sea & estuary	170	255	127	0	0	128

LCM2000 Broad Habitat descriptions

Table 6. Broad Habitats descriptions.

Broad Habitat	Description
1. Broad-leaved, mixed and yew woodland	Broad-leaved, in stands > 5 m high with tree-cover > 20%; or scrub < 5 m and yew woodland with cover >30%. Mixed woodland is included if broadleaved trees in conifers cover > 20%. Stands > 0.5 ha are mapped as separate blocks.
2. Coniferous woodland	Coniferous woodland, semi-natural and plantations, with cover > 20%, and recently felled forestry. Once felled areas are colonised by rough grass, heath or scrub, they take that class.
3. Boundaries and linear features	Larger linear features such as shelter belts or motorways; smaller linear features (hedges, walls, smaller roads) are only recorded by the field survey.
4. Arable and horticulture	Annual crops, recent leys, freshly ploughed land, rotational setaside, and perennial horticulture crops such as berries and orchards. Once setaside is substantially vegetated with weeds or rough grass, it is included in the Improved grassland Habitat.
5. Improved grassland	Improved grasslands in swards dominated by agriculturally 'preferred' species, generally 'improved' by reseeding and/or fertilizer treatment. May be used for agriculture or amenity. Fertile pastures with Juncus effusus are included. Setaside grass is included but, where possible, distinguished at the subclass level; abandoned or little-managed Improved grasslands may be confused with semi-natural swards.
6.Neutral grassland 7.Calcareous grassland 8. Acid grassland	Acid, neutral and calcareous semi-natural swards are generally not reseeded or fertilizer treated; they are dominated by lower productivity grasses, perhaps with many herbs. Grassland management may obscure distinctions from Improved grassland. Neutral, calcareous and acid components are distinguished at subclass level using a soil 'acid sensitivity' map. Pastures with Juncus effusus and with semi-natural spectral-characteristics are included with acid swards.
9. Bracken	The bracken Habitat is, at the height of the growing season, dominated by Pteridium aquilinum. Where images pre-date the late growing season, or where stands are dissected, bracken may be missed.
10. Dwarf shrub heath	Ericaceous species and gorse forming > 25% of plant cover; open and dense heaths are divided at subclass level. The Habitat includes wet and dry categories but ericaceous vegetation on peat > 0.5 m deep is recorded as 'bog'. In contrast, LCMGB 1990 used a definition based on presence of seasonal standing water.
11. Fen, marsh and swamp	Vegetation which is permanently, seasonally or periodically waterlogged. Swamps, fens and flushes are seldom extensive enough to map from satellite images. Rush pastures are more extensive. The category does not include fertile pastures with Juncus effusus.
12. Bog	Bogs include ericaceous, herbaceous and mossy vegetation in areas with peat >0.5 m deep; ericaceous bogs are distinguished at subclass level. Inclusion of Ericaceous bogs contrasts with LCMGB 1990 where bogs were herbaceous or mossy in seasonal standing water.
13. Standing open water and canals 14. Rivers, streams	Water bodies > 0.5 ha are mapped, but only the wider canals and rivers (>50 m) are shown. LCM2000 does not distinguish standing from flowing water.
15. Montane Habitats	Prostrate dwarf heath, sedge and rush, moss heaths and snow bed communities. Limited access during field reconnaissance may limit the accuracy of distinctions.
16. Inland rock	Natural and man-made bare ground, including waste tips and quarries
17. Built-up areas and gardens	Urban land, rural development, roads, railways, waste and derelict ground, including vegetated wasteland, gardens and urban trees. In LCM200, all larger areas of vegetation (> 0.5 ha) are identified as the appropriate cover class. Continuous urban and discontinuous suburban cover are distinguished at subclass level.
18. Supra-littoral rock 19. Supra-littoral sediment	Supra-littoral Habitats, created by coastal processes of erosion and/or accretion, lie above mean high water spring tides; distinction used a maritime mask. Separation of sediment rock and sediment was at subclass level, through spectral and interactive processing
20. Littoral rock 21. Littoral sediment	Littoral Habitats lie below mean high water spring tides in a zone defined by a maritime mask. Rocks and sediments were separated at subclass level by semi-interactive processing. Littoral rocks are generally limited in extent; sediments may be extensive. Saltmarsh is included with Littoral sediments, but as a separate subclass.
22. Inshore sublittoral sediment.	Areas of sea and estuary are assumed to be inshore and with sublittoral sediment. Thus; 23- Inshore sublittoral rock, 24- Offshore shelf sediment, 25- Offshore shelf rock, 26- Continental shelf slope, and 27- Oceanic seas, are not distinguished in LCM2000.

Further Information

See the Land Cover Map home page at www.ceh.ac.uk/data/lcm

Enquiries: email spatialdata@ceh.ac.uk or phone 01491 692315, ask for Land Cover Map sales.

For further information on the methodology developed and used to create Land Cover Map 2000:

Fuller, R.M., Smith, G.M., Sanderson, J.M., Hill, R.A., & Thomson, A.G. (2002). The UK Land Cover Map 2000: construction of a parcel-based vector map from satellite images. *Cartographic Journal, 39. 15-25.*

Smith, G.M., Fuller, R.M., Sanderson, J.M., Hill, R.A. and Thomson, A.G., 2001. Land Cover Map 2000: a parcel-based map from satellite images. Proceedings of the 1st Annual Remote Sensing and Photogrammetry Society Conference, *Remote Sensing Society, Nottingham. CDROM*

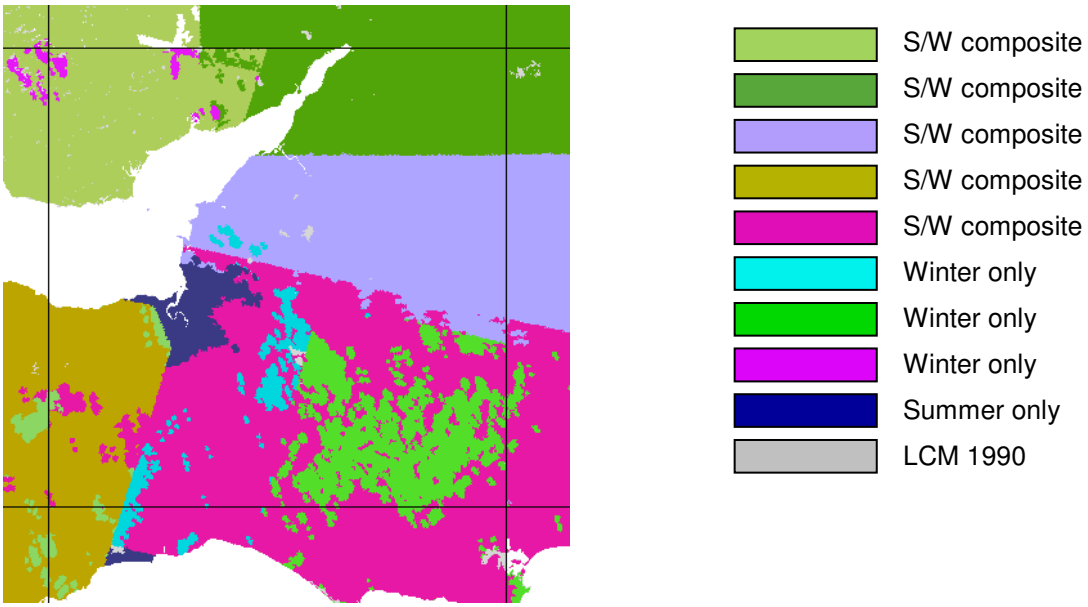
For a detailed description of the Broad Habitat Classification:

Jackson, D.L. 2000. JNCC Report No. 307. Guidance on the interpretation of the Biodiversity Broad Habitat Classification (terrestrial and freshwater types): definitions and the relationships with other habitat classifications*. Joint Nature Conservation Committee, Peterborough.*

Appendix 1: Dealing with edge overlap problems.

The construction of LCM2000 from numerous overlapping images along with the patching of cloud holes using imagery from alternative dates, has caused each 100km tile to contain multiple layers of overlapping land parcels. See Figure 2. The overlaps were removed by a series of erosion and merging operations to produce a single layer of land parcels. Land parcels that straddle the 100km tile edge were retained in both adjoining 100 km tiles.

Figure 2. The mosaic of different source imagery used in constructing 100km square ST.

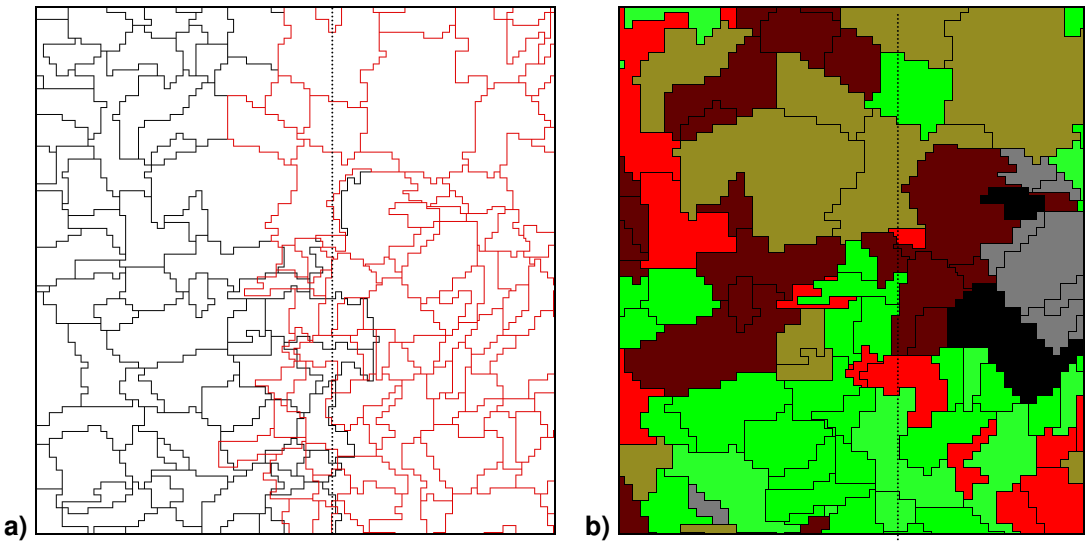


Where overlaps were removed at the edge of a 100km tile a number of artefacts related to classification and parcel geometry may have been produced:

- Land parcels may have been classified using different imagery if the image overlap coincided with the tile edge.
- The same land parcel may have undergone different erosion and merging operations depending on which tile it was in.
- Land parcels smaller than the minimum mappable unit and slivers may remain due to failures of the erosion and merging operations.

These artefacts are infrequent, and generally represent less than 0.1% of the land parcels contained within a 100km tile. The minor impact of these artefacts on the data set is more appropriately dealt with by the user, if they deem it necessary. The information contained in this note will help users to deal with these artefacts when they occur in the data they have received.

Figure 3. a) A section of 100km tile edge showing a normal situation in the upper half and artefacts present in the lower half. b) The same data coloured up at LCM2000 Level 2.

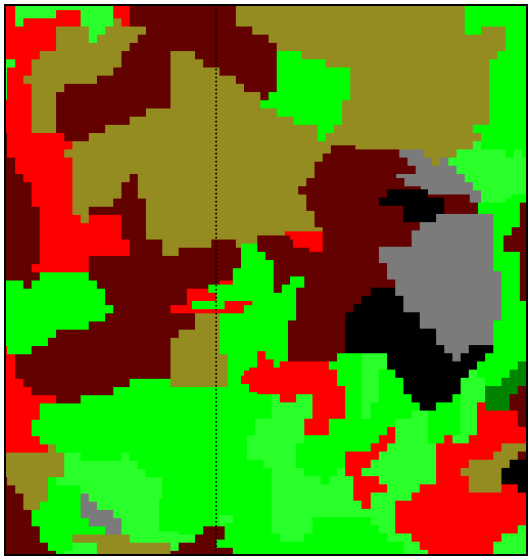


Note: Adjacent land parcels within the same class are not merged therefore boundaries between the same classes are present.

How to deal with an edge artefact problem visually.

Users may wish to 'tidy up' the smaller parcels along the edge visually. Dissolving of boundaries between same classes will give a cleaner join here. Dissolving boundaries in this way can be done either for the whole combined data set or for selected edge areas. It is not recommended that boundaries are dissolved across the whole map because attribute information at the parcel level will be lost. Users can visually remove boundaries between adjacent parcels with the same classification. This is normally done using the 'legend' tools of ArcMap. Simply make 'outlines' transparent and the result will appear as in Figure 4. In this way the source data are not degraded in any way.

Figure 4. The edge after 'dissolving' of boundaries at Level 2.



How to deal with an edge artefact problem in the data.

Assuming ArcMap is being used, there are a number of possible approaches to removing the edge artefacts between 100km tiles.

- The data can be clipped to the 100km square edge. This will clip, or chop polygons that overlap the edge. The ArcMap 'Geoprocessing wizard..' 'Merge themes' function (using **bhsub** attribute) can be used to join two or more 100km tiles together. However, be aware of the ramifications of doing this. First, LCM2000 data contain attributes that provide information at the 'whole parcel' level, such as the total pixel count and the image history information. These attributes are derived from the source data, and will no longer be valid once a parcel has been clipped at the edge of a 100km tile. 100km tiles are vector based and can contain many thousands of parcels which, if merged, will cause a significant slowing down of display and GIS analysis operations.

- The 'Union' function can be used on the 100km tiles. This will retain copies of both sets of attributes for parcels that overlap, but again, the new sets of edge parcels will have some incorrect attribute data as described above.

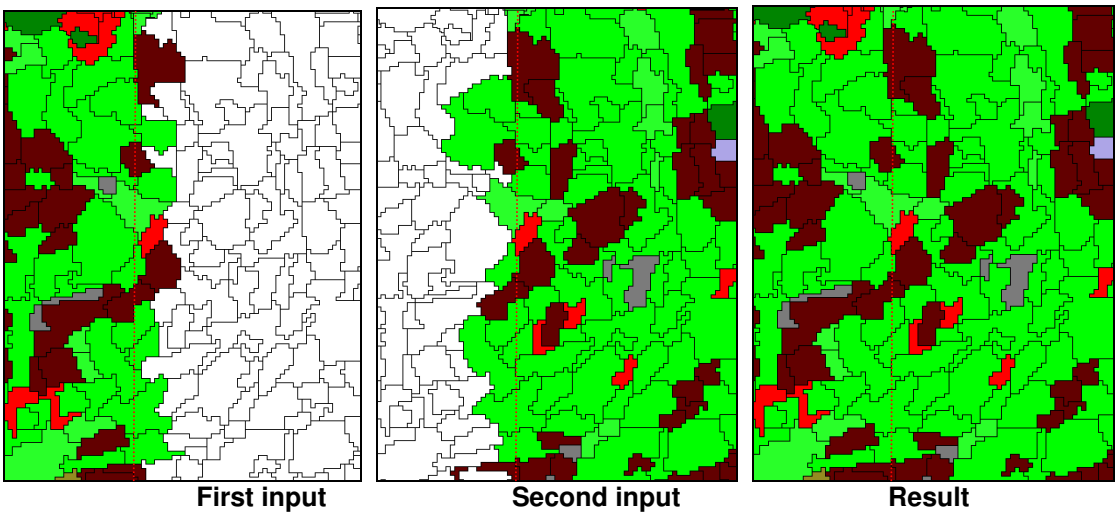
After either of these processes has been performed, the 'Geoprocessing wizard..' 'Dissolve' function can be used to remove boundaries between like classes at the Level 2 classification. Again this process invalidates some of the additional source attribute information.

For Level 3 data it is necessary to use the **bhsubvar** attribute during a dissolve function or the important Level 3 classification information will be lost. Again this process invalidates some source attribute information.

In some cases it is possible to perform a data selection using the ArcMap 'select feature' tool before performing a 'dissolve'. For instance, if you have merged two 100km tiles, then select all the edge area using the select feature, rectangle tool. All the near edge parcels will be highlighted. Dissolving boundaries at Level 2 will now be much quicker.

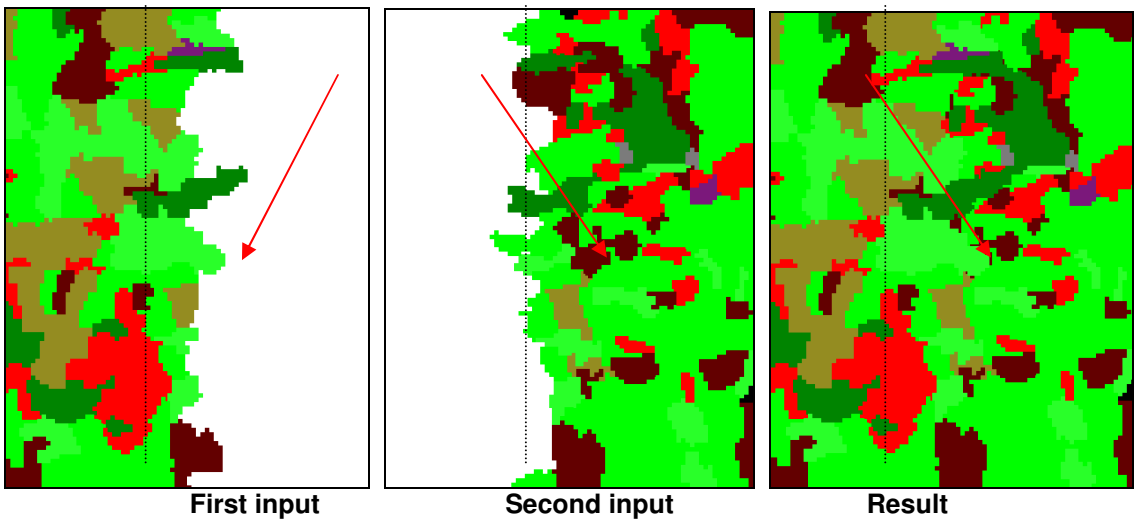
When merging 100km tiles it is normal that the first tile entered into the input datasets will take precedence over subsequent input tiles. As a result, at the edge overlap, only the attributes from the first input tile will be retained in the output, merged dataset. See Figure 5.

Figure 5. Combining 2 tiles – affect of priority input (little effect).



In this example, because the classification at the edge of both 100km tiles is virtually identical, there is no difference caused by the order of input of the tiles. However, some parcels at the edge classified differently, see Figure 6. The left tile has priority.

Figure 6. Combining 2 tiles – affect of priority (some effect)



In the example above, the left tile has a parcel classified as improved grass (green), but the right tile has classified it as tilled land (dark brown). The output adopts the improved grass class.

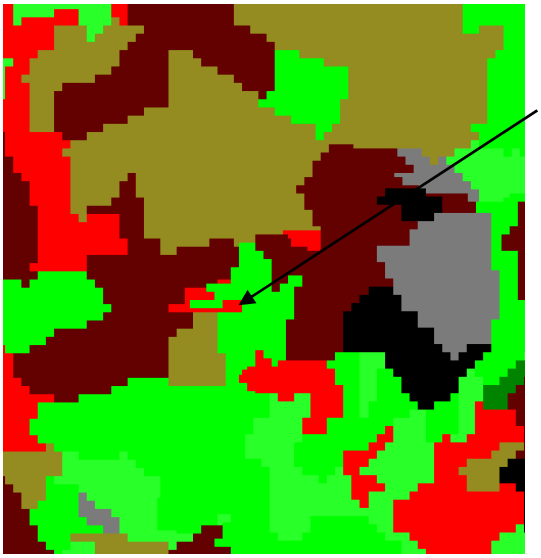
How to deal with 'slivers'.

'Slivers' and other parcels smaller than the minimum mappable unit may be present within the data. The latter are generally related to the use of LCM1990 data to patch cloud holes (see Figure 4). In either case, this data have been subjected to a subsequent 'knowledge based' correction procedure, which was one of the final quality controls employed for all data. These small parcels can be dealt with by the users in a number of ways:

- Visual removal using the legend tool described earlier.
- Parcels can be combined with adjacent parcels with the same cover class using 'dissolve' functions.
- Parcels can be 'intelligently' dissolved into the adjacent parcel with which it shares the longest boundary using advanced GIS functions.

This last option may be preferable when a small parcel has a land cover class attribute that is different from its surroundings, as identified in Figure 9.

Figure 7. An isolated small parcel suitable for 'intelligent removal' using the spatial context of surrounding data.



An isolated small parcel of broad leaf woodland.

The user can either dissolve the boundary adjacent to the most similar class (if there is one), or dissolve, based on the longest shared boundary.

In all cases of small parcel problems, users should remain aware of the significance of these artefacts in the context of the whole dataset.

Appendix 2: Good practice

Customisation

LCM2000 is more than just a map. It is a data storage and analysis framework which not only provides inputs into environmental applications, but can also be the starting point or foundation on which further research and applications work is based. The user is encouraged to alter and expand their version of the database as they see fit.

Unique labelling

As part of the production process each parcel was given a unique label which was stored in the Segid attribute. All users of the LCM2000 vector products will receive data containing this attribute. It is recommended that the Segid attribute is retained within the LCM2000 dataset and any developments of it. This will allow unambiguous communications back to the LCM2000 data management team and between LCM2000 users.

Production philosophy

When developing the methods for LCM2000 production it was decided to retain as much information as possible. This has resulted in LCM2000 being an information rich dataset. It is recommended, when altering LCM2000 data, that a similar philosophy is followed. Use parcel level meta-data attributes to record its lineage or process history. When changing attributes originally supplied with the LCM2000 data, keep a copy of them in a new attribute or assign changes into a new attribute.

Documenting changes

Fully documenting changes to a database is essential for efficient and effective data management and security. This information will help when proving feedback to the LCM2000 data management team.

Accuracy or correspondence

Users should take care not to refer to inaccuracy if they mean differences due to data model, scale, resolution, interpretation, class-definition, target classes etc. LCM2000 incorporates inevitable inaccuracies, but they may not be the major cause where it fails to match user needs.