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**CEH contract report
to the
Department of the Environment, Transport and the Regions**

**The production of a dataset
for the Countryside
Information System
describing English Counties
and Districts, and Boroughs
and Unitary Authorities in
Britain**

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Executive Summary

Digital cartographic information describing counties, districts, boroughs and unitary authorities was provided to CEH by the Department of the Environment, Transport and the Regions. The information was geo-registered with the data already held in the Countryside Information System (CIS) and a new datafile containing the information was produced.

The geographical units define areas of administration for local government. Originally there had been a two tier system, with counties and districts, but over the past 30 years many areas have now become unified, under a unitary authority. The CIS previously only held county boundaries and the metropolitan districts. The new dataset contains additional about all levels of management of local government.

The new county dataset only overlaps with the districts that are nested perfectly within them. The boundaries of the Unitary Authorities, the London Boroughs and Metropolitan Districts adjoin perfectly. During the allocation of squares to the different categories the same hierarchical rules applied.

Where the original county definitions extended beyond the new definitions to cover coastal squares, the new file was modified. The districts, boroughs and unitary authorities were not updated in this way. A comparison between the county dataset produced with the original CIS showed good agreement. Only in those cases where no new allocation had been made and there was a land class, or where the square had shifted between countries giving an inappropriate land class were squares reallocated. This is necessary to maintain the integrity of the Countryside Survey datasets using the ITE Land Classification. The remaining differences were attributed to some boundary changes and different line positioning in the base data.

Proposals for adjustments to improve the agreement with the previous county dataset are presented. The process will require manual alteration of the datasets and may be time consuming, but will also weaken the link between the dataset produced and the digital county boundary information provided.

Contents

Executive Summary

Contents

Introduction 1

Methods 2

Output 4

Proposed further modifications 11

Summary 11

References 11

Introduction

The Countryside Information System (CIS) is a computer software tool for presenting and summarising spatial information about Great Britain and Northern Ireland (Howard et al., 1994). CIS holds information on GB using a 1 kilometre raster and allows it to be subdivided in a variety of ways including the use of pre-determined groupings of squares. The system is flexible and allows users to define and store their own groups of squares for reporting, but some groups such as counties have a wider interest and are provided as separate files along with the system.

CIS was developed during the late 1980s and early 1990s with a consequence that the county file is dated, representing the 1974 realignment of boundaries. Since then, some of the county boundaries have been adjusted while others have been shifted to become unitary authorities. A new file defining the counties and unitary authorities is needed; the file needs to be conservative in its changes so that the ITE Land Classification is not compromised with land classes straying across national borders (England/Scotland or England/Wales).

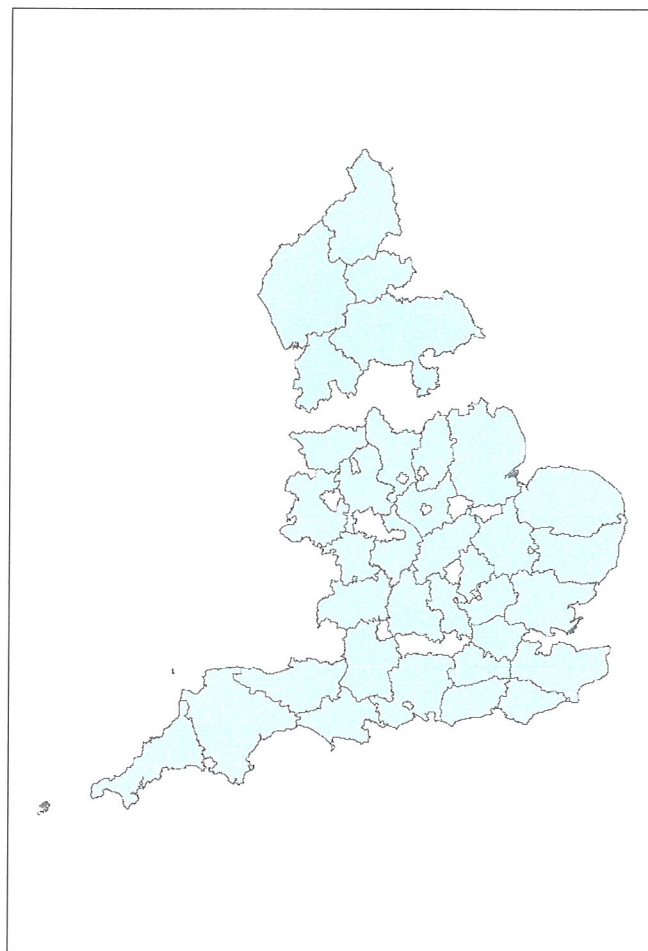
Counties do not fill kilometre squares, but have complex boundaries that divide squares. However, for use in the CIS, an allocation routine is required that will assign each square to a single county. Within a modern GIS, the technique is relatively straightforward, but there are a number of potential routes. Squares can be allocated by the identifying the county with largest area (area weighting), alternatively, the county occupying a set position within the square (such as the centre) could be used (point in polygon), or some form of re-sampling approach may be used. In this case an area-weighted approach was used.

Once the county allocation has been made, the outcome will be compared with the previous county allocation and the land class distribution. Squares on the coast in which sea is the dominant cover type also required special allocation

Methods

Two digital map coverages were supplied to CEH from DETR's GIS unit (Figure 1 and 2). Both contained polygons defined by vectors describing the boundaries, one for the counties in England, the other contained districts, boroughs and unitary authority regions in Great Britain. Information was in supplied ArcView shape file format, but for the allocation they were transferred into Arc Info vector coverages. The coverages were then converted into a 1 kilometre resolution raster (Grid) and the geo-registration with the existing data in CIS checked.

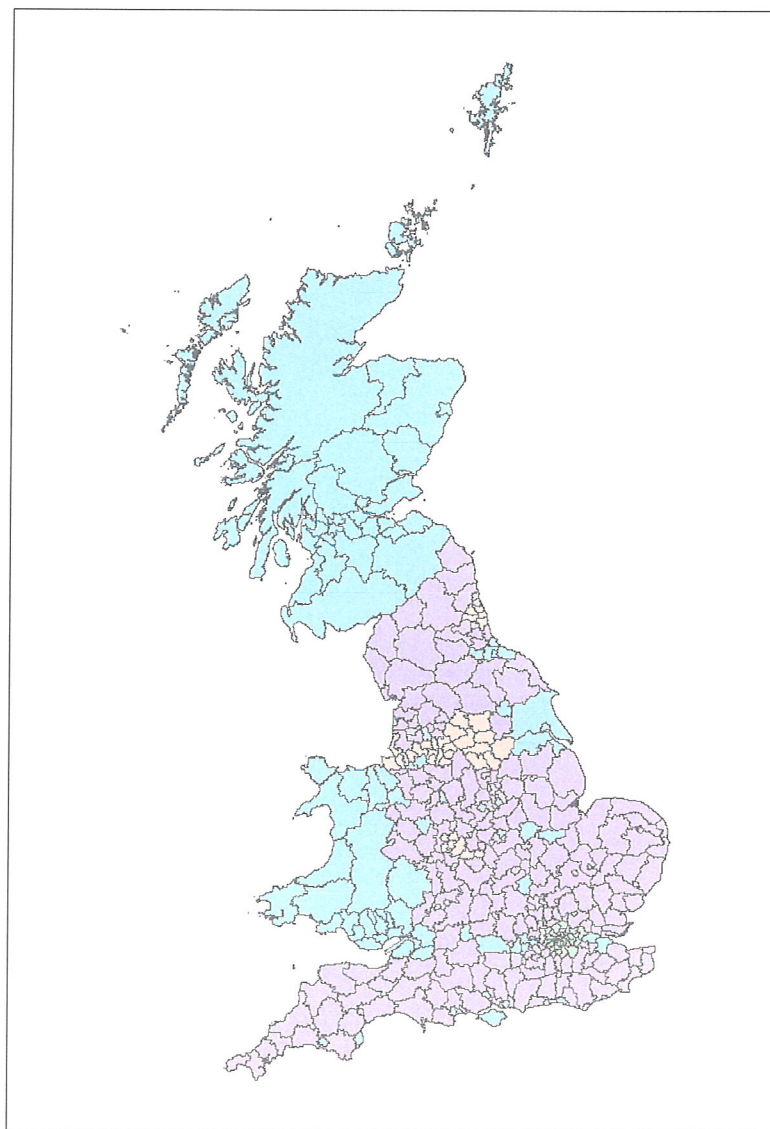
Figure 1 English counties as presented in COUNTY_REGION, an ArcView shape file



Once the spatial co-registration was accepted, the Grid raster was converted into a point coverage, with a grid reference for each grid cell. The coordinates were then added to the attribute file associated with the points. The grid coordinates and area identifier were then extracted into an ASCII text file which was edited to reduce the grid reference to kilometre resolution. The datafile was then loaded into the CIS and compared with existing files.

Where squares had shifted county, they were left, with the exception of those squares that had shifted country. The land classes, following the production of the ITE National Land Classification now show differences across national borders (land class 17 split between England and Wales and all classes between England and Scotland). Coastal squares previously identified as belonging to a county, but omitted during the analysis due to the extent of sea within them were identified in the CIS and formatted in a way to allow them to be combined with the county data. Districts, boroughs and unitary authority areas were also allocated to these squares by visual examination.

Figure 2 British districts, boroughs and unitary authorities as presented in the ArcView shape file DISTRICTS_BOROUGHES_UNITARY_REGION. Districts are shown in lilac, unitary authorities in pale blue, London boroughs in green and metropolitan districts in tan.

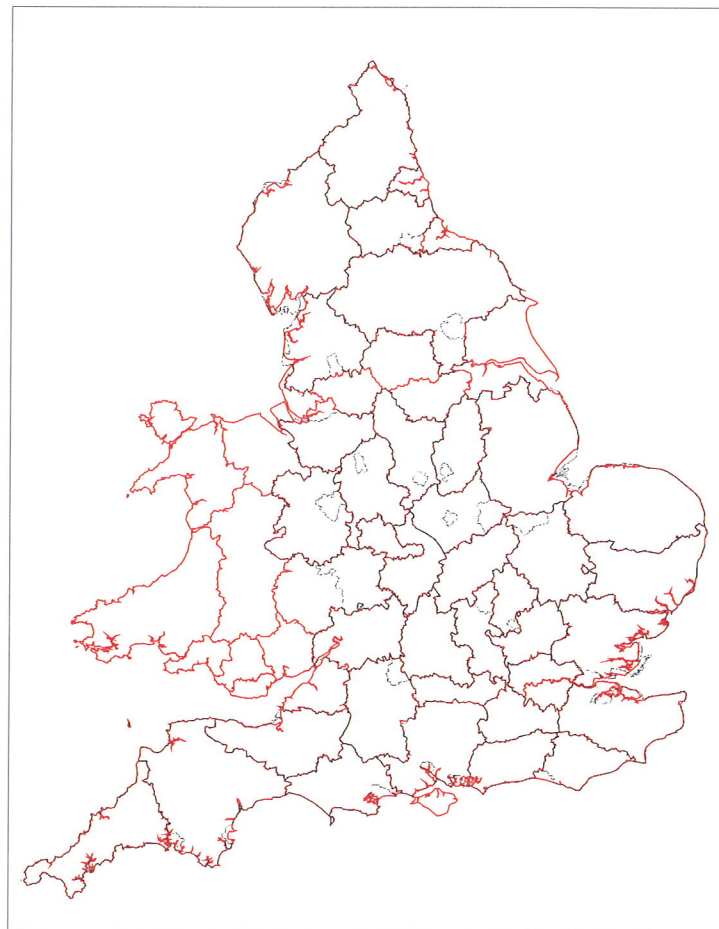


Output

The product of the analysis is a CIS census datafile containing two datasets. A comparison of the membership of the counties with the previous county dataset is provided in Table 1. Only 282 kilometre squares (approximately 0.25%) do not lie on the leading diagonal showing a change of county. Some of these represent real changes in the county border, but the majority reflect minor differences in the location of the borders between counties in different digital coverages.

Figure 3 shows the two sets of lines superimposed.

Figure 3 Two sets of line work describing county boundaries. The background set in red is the linework used to define the original CIS counties, the foreground black lines show the new linework.



At a national scale, the agreement appears to very good, the background linework shown in red is printed at twice the width of the new dataset that is overprinted in black— perfection would show black lines surrounded by two thin red lines one on each side.

Table 1 shows the squares allocated an English county, but having a Scottish land class; the squares were reallocated to the other county within them. Table 2 shows the opposite case, where squares were assigned to a Unitary Authority in Scotland, but with English land classes; these squares were also swapped as shown in the table.

Table 1 Squares allocated a county and district in England but having a Scottish land class. UTA denotes the Unitary Authority they were transferred into.

<i>Easting</i>	<i>Northing</i>		<i>From County</i>		<i>From District</i>		<i>To UTA</i>
328	564	5	Cumbria	107	Carlisle	66	Dumfries & Galloway
378	611	33	Northumberland	192	Alnwick	68	Scottish Borders

Table 2 Squares allocated a Scottish Unitary Authority (UTA) but having an English land class. The county and district show the groups in in England they were transferred into.

<i>Easting</i>	<i>Northing</i>		<i>From UTA</i>		<i>To County</i>		<i>To District</i>
332	567	66	Dumfries & Galloway	5	Cumbria	107	Carlisle
337	573	66	Dumfries & Galloway	5	Cumbria	107	Carlisle
338	573	66	Dumfries & Galloway	5	Cumbria	107	Carlisle
342	576	66	Dumfries & Galloway	5	Cumbria	107	Carlisle
346	581	68	Scottish Borders	5	Cumbria	107	Carlisle
355	587	68	Scottish Borders	5	Cumbria	107	Carlisle
359	596	68	Scottish Borders	33	Northumberland	190	Tynedale
366	603	68	Scottish Borders	33	Northumberland	190	Tynedale
367	604	68	Scottish Borders	33	Northumberland	190	Tynedale
378	609	68	Scottish Borders	33	Northumberland	192	Alnwick
378	610	68	Scottish Borders	33	Northumberland	192	Alnwick
387	616	68	Scottish Borders	33	Northumberland	192	Alnwick
386	622	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed
381	634	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed
380	635	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed
384	639	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed
394	655	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed
397	657	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed

However, but Figure 4 shows the linework at a finer scale and the difference between the two sets is clearer. The grey grid shown in the figure is the 1 kilometre resolution network of the Ordnance Survey national grid.

Figure 4 Two sets of line work describing county boundaries of Devon and Cornwall. The background set in red is the linework used to define the original CIS counties, the foreground black lines show the new linework. The grey grid is the Ordnance Survey national grid at 1 km resolution.

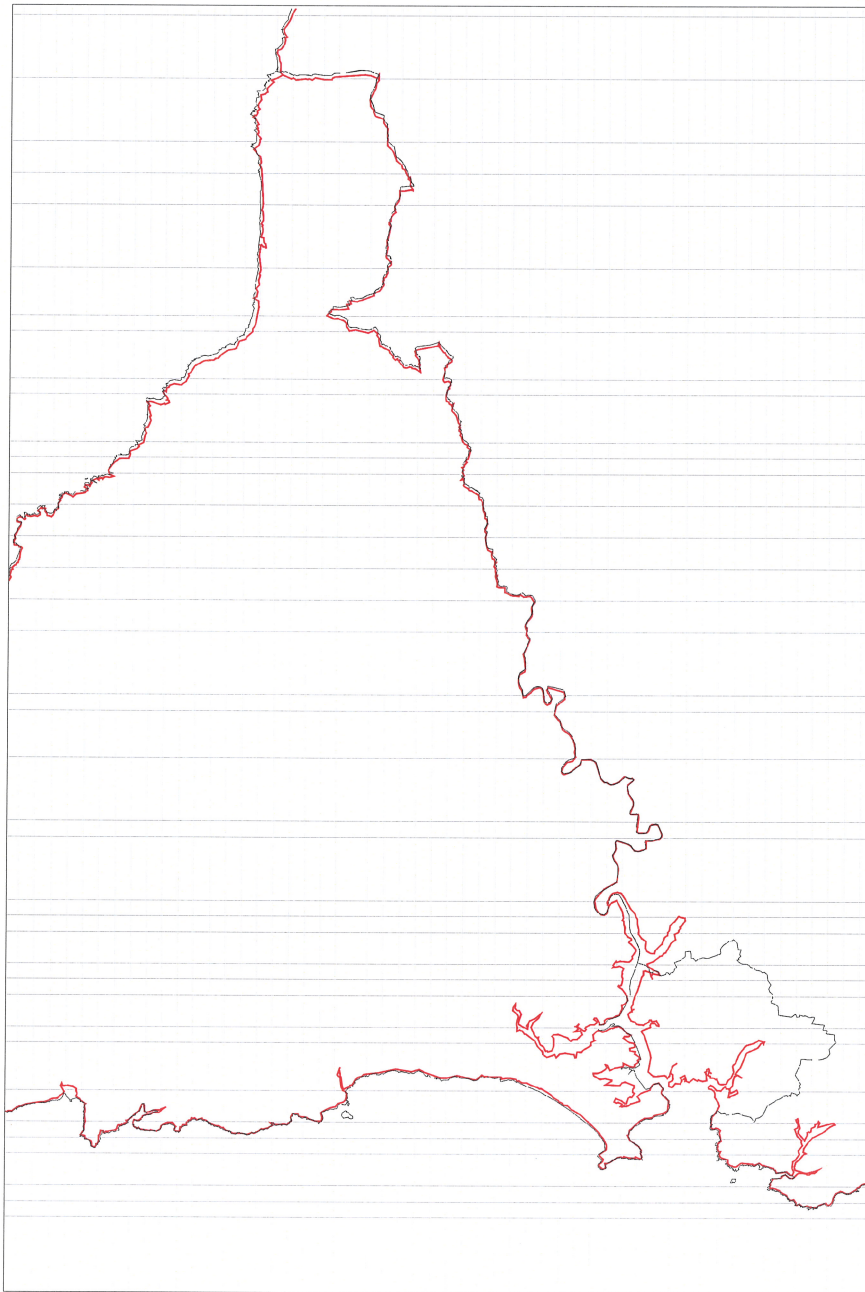


Table 1 shows the squares allocated an English county, but having a Scottish land class; the squares were reallocated to the other county within them. Table 2 shows the opposite case, where squares were assigned to a Unitary Authority in Scotland, but with English land classes; these squares were also swapped as shown in the table.

Table 1 Squares allocated a county and district in England but having a Scottish land class. UTA denotes the Unitary Authority they were transferred into.

<i>Easting</i>	<i>Northing</i>		<i>From County</i>		<i>From District</i>		<i>To UTA</i>
328	564	5	Cumbria	107	Carlisle	66	Dumfries & Galloway
378	611	33	Northumberland	192	Alnwick	68	Scottish Borders

Table 2 Squares allocated a Scottish Unitary Authority (UTA) but having an English land class. The county and district show the groups in in England they were transferred into.

<i>Easting</i>	<i>Northing</i>		<i>From UTA</i>		<i>To County</i>		<i>To District</i>
332	567	66	Dumfries & Galloway	5	Cumbria	107	Carlisle
337	573	66	Dumfries & Galloway	5	Cumbria	107	Carlisle
338	573	66	Dumfries & Galloway	5	Cumbria	107	Carlisle
342	576	66	Dumfries & Galloway	5	Cumbria	107	Carlisle
346	581	68	Scottish Borders	5	Cumbria	107	Carlisle
355	587	68	Scottish Borders	5	Cumbria	107	Carlisle
359	596	68	Scottish Borders	33	Northumberland	190	Tynedale
366	603	68	Scottish Borders	33	Northumberland	190	Tynedale
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384	639	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed
394	655	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed
397	657	68	Scottish Borders	33	Northumberland	191	Berwick-upon Tweed

The English and Welsh border was also checked, especially with respect of land class 17, which had been split into four groups before Countryside Survey 2000. Only one of the groups (17e) occurs in England, the others are only found in Wales (17w1, 17w2 and 17w3). Of the 11 squares previously classified as Welsh were now in English Counties only 2 were in land class 17 (one in 17w2 and one in 17w3) the rest were in classes 7, 8, 9 and 13 and so did not require re-allocation. Of the 17 squares previously considered as English, but now Welsh three squares were in land class 17e and so had to be reallocated. Of the others, seven were in class 13, two in class 15 and one each in classes 1, 5, 8 and 9. Details of the transferred squares are shown in Table 3.

Table 3 Squares on the English re-allocated to the second largest county area to maintain the integrity of the ITE Land Classification.

<i>Easting</i>	<i>Northing</i>	<i>From Unitary Authority</i>	<i>To County</i>
331	225	10 Powys - Powys	23 Shropshire
			<i>To District</i>
331	225	10 Powys - Powys	85 South Shropshire District
			<i>To Unitary Authority</i>
323	252	10 Powys - Powys	98 County of Herefordshire
332	295	8 Sir Fynwy - Monmouthshire	98 County of Herefordshire
331	266	98 County of Herefordshire	10 Powys - Powys
325	238	98 County of Herefordshire	10 Powys - Powys

The consequences of using a kilometre square raster to present sinuous areas are shown in Table 4. Only areas and numbers of squares of the English counties are presented, but it can be seen that these show variable agreement, the counties with the greatest deviation are Cornwall and Devon, this is because they have the longest length of coast with respect to their area. Squares were allocated to a county if they contained any land, so the number of squares exceed the area. Some counties, such as Buckinghamshire show very good agreement, but it must be remembered that they will still contain land from neighbouring counties and their land will also occur in squares allocated to other counties.

The effect of the allocation is more marked in the other types of authority, as the areas are on average smaller. The smallest authority (City and County of the City of London) contains only three squares. It is not recommended that the CIS be used to examine information divided into units of this size.

Table 4 The relationship between the number of squares allocated to a county and its land area (km²) in the original ArcView Shape file.

<i>County</i>	<i>Squares</i>	<i>Area</i>
Bedfordshire	1193	1192.1
Buckinghamshire	1565	1564.9
Cambridgeshire	3059	3054.0
Cheshire	2114	2107.5
Cumbria	7215	7182.2
Derbyshire	2553	2550.7
Dorset	2670	2572.9
Durham	2247	2232.7
East Sussex	1724	1725.3
Essex	3721	3694.5
Gloucestershire	2705	2704.5
Hampshire	3776	3739.1
Hertfordshire	1638	1643.1
Kent	3690	3639.1
Lancashire	3096	3083.4
Leicestershire	2075	2083.8
Lincolnshire	6126	6106.6
Norfolk	5558	5498.0
Northamptonshire	2370	2367.0
North Yorkshire	8094	8053.1
Nottinghamshire	2098	2087.0
Oxfordshire	2613	2605.9
Shropshire	3193	3197.3
Somerset	3533	3516.2
Staffordshire	2618	2623.3
Suffolk	3896	3854.4
Surrey	1673	1670.0
Warwickshire	1976	1977.5
West Sussex	2048	2030.2
Wiltshire	3288	3255.3
Worcestershire	1735	1740.5
Greater London Authority	1597	1594.7
Northumberland	5131	5078.4
Devon	6791	6637.0
Cornwall	3856	3613.5

The agreement between the former county definition and the new definition can be seen in tables 5a and 5b. There are 476 squares laying of the leading diagonal (agreement) which represents about 0.5 %.

Table 5a

A cross tabulation of numbers of squares in counties in the first CIS county file (rows) compared with the updated version (columns)

	BEDFORDSHIRE	BUCKINGHAMSHIRE	CAMBRIDGESHIRE	CESHIRE	CUMBRIA	DERBYSHIRE	DORSET	DURHAM	WILTSHIRE	ESSEX	GLOUCESTERSHIRE	HAMPSHIRE	HERTFORDSHIRE	KENT	LANCASHIRE	LEICESTERSHIRE	LINCOLNSHIRE	NORFOLK	NORTHAMPTONSHIRE	NORTH YORKSHIRE	NOTTINGHAMSHIRE	OXFORDSHIRE	SHROPSHIRE	SOMERSET	STAFFORDSHIRE	SUFFOLK	SURREY	WARWICKSHIRE	WEST SUSSEX	EAST SUSSEX	HEREFORD & WORCESTER	GREATER LONDON	NORTHUMBERLAND	DEVON	CORNWALL	No. of Mismatches
Bedfordshire	1185																																			1
Buckinghamshire	1	1556																																		14
Cambridgeshire	3	3052																																		21
Cheshire			2091																																	2
Cumbria				7003																																2
Derbyshire					2539																															2
Dorset						2665																														7
Durham							2234																													6
East Sussex																																				10
Essex																																				48
Gloucestershire																																				16
Hampshire																																				6
Hertfordshire	2	3																																		20
Kent																																				8
Lancashire																																				6
Leicestershire																																				4
Lincolnshire																																				11
Norfolk																																				4
Northamptonshire	2	1																																		9
North Yorkshire																																				7
Nottinghamshire																																				5
Oxfordshire																																				11
Shropshire																																				8
Somerset																																				7
Staffordshire																																				3

Table 5b

A cross tabulation of numbers of squares in counties in the first CIS county file (rows) compared with the updated version (columns)

	BEDFORDSHIRE	BUCKINGHAMSHIRE	CAMBRIDGESHIRE	CHESHIRE	CUMBRIA	DERBYSHIRE	DORSET	DURHAM	WILTSHIRE	ESSEX	GLOUCESTERSHIRE	HAMPSHIRE	HERTFORDSHIRE	KENT	LANCASHIRE	LEICESTERSHIRE	LINCOLNSHIRE	NORFOLK	NORTHAMPTONSHIRE	NORTH YORKSHIRE	NOTTINGHAMSHIRE	OXFORDSHIRE	SHROPSHIRE	SOMERSET	STAFFORDSHIRE	SUFFOLK	SURREY	WARWICKSHIRE	WEST SUSSEX	EAST SUSSEX	HEREFORD & WORCESTER	GREATER LONDON	NORTHUMBERLAND	DEVON	CORNWALL	No. of Mismatches
Suffolk			1							6								3								3875										10
Surrey										1		1														1663						3				11
Warwickshire																																				7
West Sussex									2		1	4															1959				1					11
Wiltshire											3	1															1									7
Hereford & Worcs											6																									7
Gtr London										6			7	3													6				5	1729				11
Northumberland					3			1																												22
Devon							1																													4
Cornwall																																				4
Avon																																				6
Berkshire	2										18																									8
Borders												3																								20
Cleveland								2																												8
Clwyd				3																																8
Dumfries & Gall.																																				8
Gtr Manchester			2																																	20
Gwent						2					3																								8	
Humberside																																				8
Merseyside				4																																8
Powys																																				8
South Yorkshire					1																															8
Tyne and Wear								9																												9
West Midlands																																				9
West Yorkshire																																				9

Proposed further modifications

The internal county definitions new dataset have been adjusted to match the original county definitions only where those definitions cross national borders. Other discrepancies are the result of differences between the two digital boundaries used as the source. It is possible to adjust the allocation manually, to make the county definitions consistent with those already circulated with the CIS. Apart from the time required to make the adjustment, the major drawback is that the CIS dataset will no longer have a complete direct link with its source data.

Summary

A CIS census dataset was produced containing the following datafiles:

English County	35 counties
English District	238 districts
Metropolitan District	36 districts
London Boroughs	33 borough
Unitary Authorities	100 authorities

The allocation to civil authority was automatic, using an area weighting. Only 25 squares had their allocation manually altered to maintain integrity with the ITE Land Classification.

Agreement with the existing data could only be tested with the county dataset which showed 476 mismatches out of 113,235 allocations, i.e. 0.42%.

References

Howard, D.C., Bunce, R.G.H., Jones, M., & Haines Young, R. (1994). *The development of the Countryside Information System*. Countryside 1990 Series Volume 4 Department of the Environment, London.