A Report Prepared for

The Countryside Agency

LAND USE CHANGE AT THE URBAN: RURAL FRINGE AND IN THE WIDER COUNTRYSIDE

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Department of Town and Regional Planning
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Contents

Executive Summary

This document reports on a series of data analyses commissioned by The Countryside Agency in support of its second assessment of change in countryside quality in England. It plays a part in extending the work of the *Countryside Quality Counts* project (CQC) to cover the period 1998 to 2003, and more generally contributing to addressing long-term concerns with change in countryside character and quality. The principal focus of the work reported here enriching understanding of land-use change at the urban-rural fringe and considering development and settlement-change in the wider countryside.

The work centres on analyses of the Land Use Change Statistics (LUCS) and the Postcode Address File (PAF). The key output of the work is a series of grids which can be used within an appropriate proprietary GIS to provide a variety of measures of development and settlement change and contribute to a wide range of further analyses. Each grid partitions England into tiles each representing an area a hectare in extent (ie 100m x 100m).

The LUCS data are collected by Ordnance Survey for the Office of the deputy Prime Minister as an adjunct to the process of updating basic scale maps. They are both national in scope and recorded at a very high level of geographical resolution, and provide an unparalleled resource for characterizing particular aspects of landscape change.

The Postcode Address File (PAF) is very different in character to LUCS. It is not a statistical source in any usual sense, but rather a list of postal addresses, supplemented by grid references and in the case of non-residential property by occupier names.

PAF allows highly detailed examinations of land use and of property utilisation. The pattern of new building which LUCS records is normally tempered by some demolitions. PAF allows investigation of overall change in the stock of dwellings, and allows any tendency towards intensification of existing settlements to be addressed. Comparison of PAF data for different times allows a range of inferences to be made about physical development and changing settlement. Nevertheless, the computation needed to derive such insights is substantial in scale, and the natural language processing required to draw inferences about property and about change is highly complex.

Throughout this report, reference is made to the settlement classification developed for the Countryside Agency and its collaborators and embodied within the Government's Rural Strategy. (This classification also depends upon PAF). By reporting results for settlement types and for Joint Character Areas (JCAs) it is possible to give a fairly rich picture of change in settlement and development between 1998 and 2003.

While the prime concern of the work reported here is with reporting on these aspects of change, a series of new and innovative techniques were also developed which have broad application in analysing settlement and land use change.

Section 2 (Settlement and Development 1998-2003: Grids from the Land-Use Change Statistics) relies on the Land Use Change Statistics (LUCS) collected by Ordnance Survey for ODPM in the process of updating basic scale maps. LUCS data have been used to create six key grids showing for the years 1998-2003

- the area of land developed or re-developed for built uses
- the area of land developed or re-developed for residential use
- the area of land developed or re-developed for industrial, retail or commercial purposes
- the total extent of greenfield development
- the extent of greenfield housing development
- the extent of greenfield development for industrial, retail or commercial uses

LUCS data reveal a strong tendency for development between 1998 and 2003 to be concentrated within the urban areas. Substantial greenfield development has occurred near (though not necessarily abutting) many urban areas (with the marked exception of London and Birmingham). Significant policy-driven greenfield development occurred at key growth points, but also informer coalfield belts. This latter growth seems to reflect complex settlement structures rather than representing physical expansion of the principal towns.

Much greenfield development has involved construction of housing. Such growth was been particularly marked to the east of Reading (in the Thames Valley JCA) and in parts of the South West (to the south of Stroud (Cotswolds JCA); north of Swindon (Midvale Ridge, and Upper Thames Clay Vales JCAs); east and south of Weston-Super-Mare (Somerset Levels and Moors JCA); surrounding Trowbridge / Westbury (Avon Vale JCA) and within the Lancashire and Amounderness Plain JCA,

Generally the extent of commercial and industrial development on greenfield land was limited. Clustered areas of greenfield development are apparent at particular growth points (eg around Bristol's north fringe (Bristol, Avon Valleys and Ridges, and Severn and Avon Valleys JCAs); the southern fringe of Northampton (Northamptonshire Vales JCA), Swindon (Upper Thames Clay Vales, and Midvale Ridge JCAs) and Ashford (Wealden Greensand, and Low Weald JCAs). They also are found on greenfield sites asdjoining coalfield areas (eg to the southwest of Leeds (Nottinghamshire, Derbyshire and Yorkshire Coalfield JCA; and in the Southern Magnesian Limestone, and Sherwood JCAs).

Hectare tiles have been classified in terms of their relation to existing urban areas and transport routes. Simple rules are used to identify 'pressured facets'. Overall, between 1998 and 2003, 1.17% of the area of pressured facets was converted from greenfield to developed uses- a rate 13.6 times higher than that which prevailed across the country as a whole. The rate was highest in facets on the very edge of the urban area which are less than 30 hectares in extent (16.16 times higher than typical of the country as a whole).

Section 3 (Settlement and Development 1998-2003: Grids from the Postcode Address File) uses PAF and LUCS together to appreciate both the extent of new building and the rather different pattern of net change in dwelling stocks. Between 1998 and 2003,

the stock of dwellings in the rural domain increased by 5.9%, compared with 2.2%, in the urban domain and 3% across England as a whole.

The impact of this growth is not reducible to 'urban sprawl'. Three houses in every five were accommodated *within* the urban domain, and just one new dwelling in seven was built at the urban margin (in the 'fringe' and 'periurban' zones of the 2001 settlement typology). Even this overstates the impact of new housebuilding on expansion of the *contiguous* urban area. Two new indicators of residential growth at the urban fringe were developed for this project. New indicators based on PAF and LUCS were also developed to gauge new non-residential development at the urban fringe, and charting the growth of new property objects such as 'retail parks'. This section tabulates these indicators at JCA level, together with a composite indicator of urban expansion. The various indicators highlight the extent of new business and leisure development on the fringe of medium sized towns, usually associated with policy driven growth.

The broader countryside beyond the urban fringe has not been left unaffected, at least in terms of residential development. In absolute terms, it has accommodated far more newly built dwellings and seen a greater net increase in the dwelling stock than has the urban margin. In some JCAs such as the Bedfordshire and Cambridgeshire Claylands new building alone has driven substantial increases in dwelling stock. Far less commonly, conversion activity has *combined* with new build to generate substantial increases in dwellings as in the Vale of York and Vale of Pickering JCAs. Elsewhere, especially in areas of marked planning restraint, conversions *alone* have yielded relatively significant increases in dwellings).

Particular localities within the broader countryside have shown a high degree of settlement intensification. This has been particularly marked in hamlets and isolated farms, where gains from conversion and subdivision have exceeded that of new building by a factor of four. Numbers of residential 'barn' properties within hamlets increased by more than 50%.

Only some JCAs, however, showed any tendency to settlement intensification. Many tracts of upland of high landscape quality showed no such tendency. Rural settlement intensification seems to have been most marked in three circumstances. First, in JCAs that adjoin some of the northern and midland conurbations, especially in areas historically characterized by dispersed settlement. A second circumstance is in the rural environs of planned growth centres. The third set of circumstances have to be understood in terms of accessibility to more distant locations in road and rail corridors and at a considerable distance from London.

Section 4 (Moving Forward: Integrating Datasets, Drawing Inferences, Characterizing Change) considers the possibility of developing ways of understanding change in settlement and development that characterize the types of locality that are disappearing and the types of locality that are emerging.

The approach developed uses the concept of a 'facility' –a space organized to facilitate a particular type of activity, characterized by particular patterns of behaviour, owned by or leased to single legal entity and subject to a single management. In Section 3, natural language processing methods and other techniques

from artificial intelligence were used to infer the presence and extent of particular facilities. It proves extremely difficult to develop convincing descriptions or categories for objects *broader* than the facility.

In the work described here, the idea of characterizing broader areas was not taken further, Instead, this section considers the possibility of examining both the portfolio of facilities being created and the portfolio of facilities being lost. Extending the type of technique introduced in Section 3, it is potentially possible to move from consideration of particular instances of individual facilities such as dwellings, workshops, airfields or country houses to the JCA or national level. At the same time the sort of approach developed in Section 3 might be complemented by devoting more attention to units of development and bringing together economic and historical approaches. A range of data can be brought together, reducing the gap between macroscopic and microscopic analyses and forming the basis for considering possible future landscapes.

The first step in the type of approach outlined would start be examination of the supply of land for particular uses, but paying specific regard to a pre-existing mosaic of facilities inferred from PAF. Second, tendencies underlying supply conditions would be identified, potentially prompting the release of these facilities to other uses. The third step would be to examine the extent to which these facilities come to be recognized within the planning system as land available for particular forms of development (evident in NLUD PDL and LDFs). In the fourth and final step, former facilities may become *units of development* and new facilities are created. The nature of these new facilities might be inferred using LUCS and PAF (together other sources).

The section attempts to show that this type of approach might prove useful in working through the implications for the countryside of de-industrialisation, de-militarization, shifting approaches to health and social care and changes in the organization of electricity generation.

1. Introduction

Overview

This document reports on a series of data analyses that form an input to the *Countryside Quality Counts* project (CQC). It presents a new series of analyses of change in settlement and development between 1998 and 2003, focussing on change at the urban-rural fringe and in the wider countryside. It also outlines a series of new and innovative techniques developed for the project with broad application to the analysis of settlement and land use change.

1.1 This document reports on a series of data analyses commissioned by The Countryside Agency in support of its second assessment of change in countryside quality in England. It plays a part in extending the work of the *Countryside Quality Counts* project (CQC) to cover the period 1998 to 2003, and more generally contributing to addressing long-term concerns with change in countryside character and quality. The principal focus of the work reported here is to enrich understanding of land-use change at the urban-rural fringe and consider development and settlement-change in the wider countryside.

1.2 More precisely, this document reports on module thirteen of phase four of the *Countryside Quality Counts* project. This work centres on analyses of the Land Use Change Statistics (LUCS) and the Postcode Address File (PAF). It develops and complements work recently undertaken by the University of Sheffield as part of module eight of phase four of the *Countryside Quality Counts* project. It therefore seems appropriate to describe the analyses undertaken under that latter contract. The discussion in the present document moves from fairly familiar and straightforward aspects updating previous work in the Countryside Quality Counts Programme (conducted as Module8 of Phase IV) and to more innovative analyses.

1.3 The work undertaken entails the production of a series of grids (which is the principal deliverable from Module 8 of Phase 4), and an important component of Module 13. The grids may be regarded as constituting three groups concerned respectively with: measures of development derived solely from the Land Use Change Statistics (LUCS); measures of development and changing property utilisation relying on data from PAF; and additional descriptors. Within an appropriate proprietary GIS, these data structures can be overlaid on a representation of JCAs to provide a variety of measures of development and settlement change and contribute to a wide range of further analyses.

1.4 The remainder of the document is thus organized in the following manner. Grids derived solely from the Land Use Change Statistics (LUCS) are discussed in Section 2; while those relying on PAF data are discussed in Section 3. Section 4 provides a more general discussion of issues arising in attempting to characterize the types of change identified in previous sections, and explores how additional data sets can be brought within the analytic framework used here. A number of more technical matters arise in the course of the work which are treated in a series of Appendices.

2. Settlement and Development 1998-2003: Grids from the Land-Use Change Statistics (LUCS)

Overview

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2. Settlement and Development 1998-2003: Grids from the Land-Use Change Statistics (LUCS)

2.1 This section is concerned solely with measures of development over the period 1998-2003 derived from the Land Use Change Statistics (LUCS). The form and nature of the grids generated is similar to those produced in previous work on *Countryside Quality Counts* and this work relates to a particular sub-contract to Nottingham University Consultancy Limited. Although this report is concerned strictly with work on Module thirteen, these basic grids are discussed here as an appreciation of their nature assists in understanding the more detailed analyses introduced in Sections 3 and 4. Previous work as part of the *Countryside Quality Counts Project* has defined a series of *indicators* of change based upon these standard grids, but they are not discussed in this report.

2.2 LUCS represents a very important source of data about development activity and is the principal source of data for gauging the proportion of house building accommodated on brown field sites (a contributory indicator to Government's Quality of Life Barometer). LUCS data are created whenever Ordnance Survey (OS) update the lineage or annotation of a basic scale map (ie 1:1250 in urban areas; 1:2500 at the urban fringe; 1:10000 in mountain and moorland areas). Geographic co-ordinates (at 10 metre resolution) are included, together with fields showing the year in which the change is believed to have occurred, the previous and new land uses (see Table 2.1 for categories), the number of units involved, and the areal extent of the change. In this report, each of these records will be treated as referring to a land use change (LUCS) 'event'. Each (in principle) relates to a specific parcel of land, though boundaries are not recorded.

Table 2.1: LUCS Land Use Categories

Agricultural land	A
Agricultural buildings	B
Community buildings	C
Defence	D
Forestry and woodland	F
Grassland	G
Highways and road transport	H
Industry	I
Offices	J
Retailing	K
Leisure and recreational buildings	L
Minerals	M
Natural and semi-natural	N
Outdoor recreation	O
Institutional and communal accommodation	Q
Residential	R
Storage and warehousing	S
Transport (other)	T
Utilities	U
Vacant land previously developed	V
Water	W
Urban land not previously developed	X
Landfill waste disposal	Y
Derelict land	Z

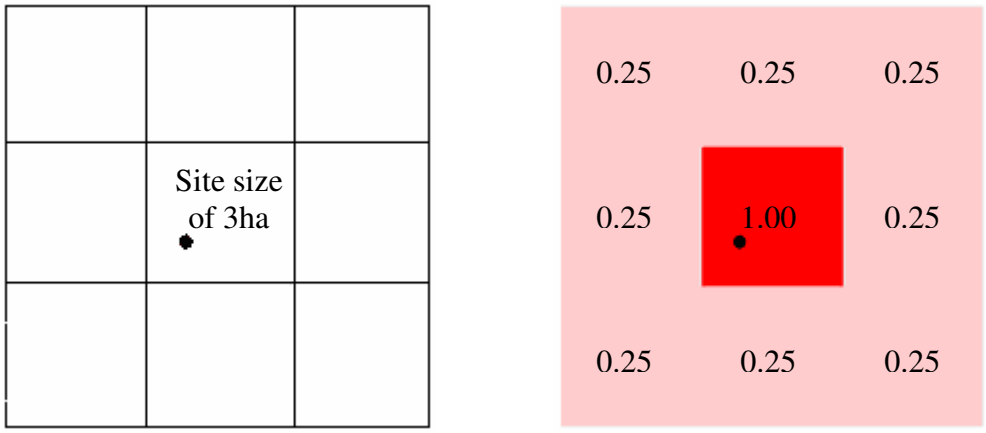
2.3 Given that the LUCS data are both national in scope and recorded at a very high level of geographical resolution, they provide an unparalleled resource for characterizing particular aspects of landscape change. Nevertheless, in using LUCS it is important to understand particular aspects of their character which derive from their origin as a by-product of map revision. The probability that a change is recorded and the timing of its recording depend upon OS survey priorities. Usually survey activity is motivated by one of two imperatives; either it is a response to intelligence concerning new built development (under continuous revision) or it forms of programmed sweep (supported by Government).

2.4 Most significant built development is captured under continuous revision. Sweep survey activity by contrast involves updating of whole map sheets and is organized using a series of ten kilometre by ten kilometre blocks. OS is committed (through an agreement with Government) to ensure basic scale mapping is updated in rural areas (ie those mapped at a basic scale of 1:25000) every five year's and in mountain and moorland areas (1:10000) every ten years. Within the bounds implied by these commitments, however, the timing of sweep survey activity is complex. For present purposes, it is necessary to appreciate that in the five year period of current concern, some areas of the country will not have been subject to sweep survey. As sweep survey plays only a limited role in generating information about built development, it is not considered further in this section (although it is very important in generating information about rural to rural changes (See Appendix Four on woodland loss)).

2.5 For the purposes of the present project, a series of grids has been constructed using the Land Use Change Statistics (LUCS). As indicated above, although every LUCS record includes an estimate of the area subject to change, each event is represented only by a single point. While the average area associated with a LUCS event involving construction of new dwellings is small (0.31 hectares), 0.02 percent of events refer to areas of greater than ten hectares.

2.6 For the purpose of the work reported here, these point data are converted to hectare grid format (ie assigned to tiles 100m by 100m). It is important to appreciate that in this conversion, those LUCS events referring to parcels in excess of one hectare will 'overflow' the tiles in which they fall. For this reason, the original point data have been 'spread' out into adjacent tiles to cover a total area equal to that associated with the event. Thus in the example below, the LUCS record has an associated site size of 3 hectares, which clearly cannot fit into the hectare cell in which the LUCS point falls. In this instance the event is forced to extend into the surrounding cells (0.25 hectares in each of the eight adjoining cells).

Figure 2.1: The Conversion of LUCS Points to Grids to Account for Areal Extents



a) LUCS point with hectare grid framework b) Site extent allocation (hectares)

2.7 The following grids were produced:

- **Lucsdev**: area of land developed or re-developed for built uses
- **Lucsdevr**: area of land developed or re-developed for residential use
- **Lucsdevc**: area of land developed or re-developed for industrial, retail or commercial purposes (LUCS categories I, J and K)
- **Lucsrulcon**: area of land developed for built uses that was not previously developed (ie area of greenfield development)
- **Lucsrulconr**: area of previously undeveloped land converted to residential use (ie area of greenfield housing development)
- **Lucsrulconc**: area of previously undeveloped land converted to industrial, retail or commercial use

2.8 Each of the grids encapsulates a particular aspect of development and settlement change with potential relevance to *Countryside Quality Counts.* The first three grids referenced above deal with development regardless of whether it involves rural land conversion, while the second group of three are concerned solely with development on greenfield sites. The **Lucsdev** grid captures the extent of all development to built uses, and immediately illustrates the strength of the tendency for development to be concentrated within the urban areas. Apart from concentration within London, there is marked belt of development running from the West Yorkshire towards the West Midlands (embracing the Nottinghamshire, Derbyshire and Yorkshire Coalfield, Trent Valley Washlands, Cannock Chase and Cank Wood, and Arden JCAs). A second similar belt stretches through the Merseyside Conurbation to the Manchester Conurbation and the Mersey Valley, Lancashire Coal Measures, Lancashire and Amounderness Plain, and Lancashire Valleys JCAs. Another substantial area of development extends through former industrial areas of the North-East, including the Tyne and Wear Lowlands, Durham Magnesian Limestone Plateau, and Tees Lowlands.

2.9 Development of major new roads in the years 1998-2003 is clearly evident. The most striking example is probably the M6 Toll to the north-east of the West Midlands conurbation (Cannock Chase and Cank Wood, and Arden JCAs). Others include the A46 between Newark-on-Trent and Lincoln (Trent and Belvoir Vales JCA); the A417 and A419 between Gloucester/Cheltenham and Swindon (Cotswolds, and Upper Thames Clay Vales JCA); the A30 north-east of Exeter (Blackdowns, and Devon Redlands JCAs); and the M20 between Maidstone and Folkestone (Wealden Greensand JCA).

2.10 In quantitative terms**,** new development is dominated by housing and hence the **Lucsdevr** grid generally mirrors the impression provided by **Lucsdev** (but with the absence of road developments). Other significant areas of housing development include areas to the north-east of Southampton (South Hampshire Lowlands JCA); Bristol (Bristol, Avon Valleys and Ridges JCAs); York (Vale of York JCA), Bournemouth and Poole (Dorset Heaths JCA), and around Telford (Mid Severn Sandstone Plateau, and Shropshire, Cheshire and Staffordshire Plain JCAs).

2.11 The overall impression provided by the **Lucsdevc** grid is (consonantly with Government policy) predominantly one of concentration in the urban areas. Again areas in the Midlands and the North (as previously described) appear strongly. Developments around Immingham and Grimsby (Humber Estuary JCA) stand out particularly sharply.

2.12 The **Lucsrulcon** grid indicates those areas where previously greenfield land was developed in the years from 1998-2003. There appears to be substantial greenfield development around (though not necessarily abutting) many urban areas, with the marked exception of London and (if road developments are excluded) Birmingham. The most obvious areas of development include the belts running from the West Yorkshire towards the West Midlands (referred to previously); that stretching from Merseyside to Greater Manchester and Lancashire; and the North-East. As will become clear below, this reflects the complex settlement structure of these (former coalfield) areas rather than representing physical expansion of the principal settlements.

2.13 Much of this greenfield development has involved construction of housing, as evident in the **Lucsrulconr** grid. This highlights some areas of particularly marked growth, including development to the east of Reading (in the Thames Valley) JCA; to the south of Stroud (Cotswolds JCA); north of Swindon (Midvale Ridge, and Upper Thames Clay Vales JCAs); east and south of Weston-Super-Mare (Somerset Levels and Moors JCA); surrounding Trowbridge / Westbury (Avon Vale JCA); and within the Lancashire and Amounderness Plain JCA, centred on former defence land at Euxton. This grid indicates areas of *land* converted to housing rather than numbers of dwellings built and so tends to draw attention to low density development. Nowhere is this more apparent than around the Wash (The Fens JCA). This would appear to account for apparently substantial construction in the Cornish Killas and Herefordshire Lowlands JCAs. The nature of development in this last JCA and its neighbours is discussed in some detail in Appendix Two.

2.14 From a national perspective ,the extent of commercial and industrial development on greenfield land (**Lucsrulconc**) is quite limited and so developments appear quite

scattered. Some major single sites are evident in the grid shown in Figure 2.2f such as developments at the former Carlisle RAF Maintenance Unit (Solway Basin JCA). Clustered areas of greenfield development are apparent around Bristol's north fringe (Bristol, Avon Valleys and Ridges, and Severn and Avon Valleys JCAs); to the south-west of Leeds (Nottinghamshire, Derbyshire and Yorkshire Coalfield JCA); the southern fringe of Northampton (Northamptonshire Vales JCA); in a corridor stretching through Kirkby-in Ashfield and Sutton-in-Ashfield toward Mansfield (Southern Magnesian Limestone, and Sherwood JCAs). Development around growth points such as Swindon (Upper Thames Clay Vales, and Midvale Ridge JCAs) and Ashford (Wealden Greensand, and Low Weald JCAs) also stand out.

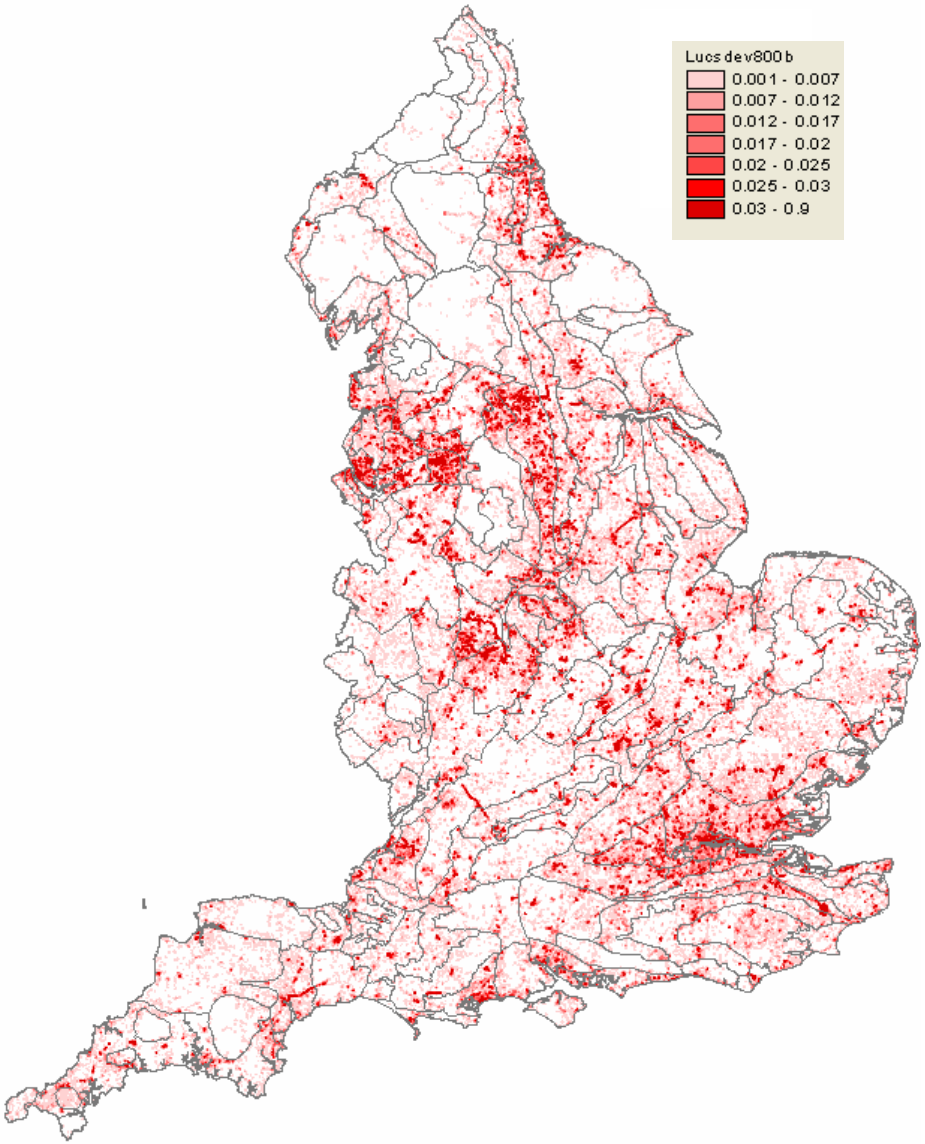
Reliability of LUCS Data

2.15 The reliability of LUCS as an indicator of change in settlement and development depends on the manner in which LUCS data are collected and their relation to the updating of OS basic scale maps. Development is dominated by residential use and residential uses are also more readily checked against other sources than other developed uses. For this reason, remarks in this document about reliability concentrate primarily on development for residential use. Critically, it is possible to make use of the number of units built as recorded on LUCS. Not only does this allow testing of the plausibility of implied densities, but also allows analysis of the relation to other sources- principally PAF. The relation to PAF is considered in some detail here, not only because it helps to understand reliability of LUCS, but because it incidentally contributes to understanding of the relationship the volume of housing output in particular areas and net change in dwellings. This is built on in the analyses of Section 3.

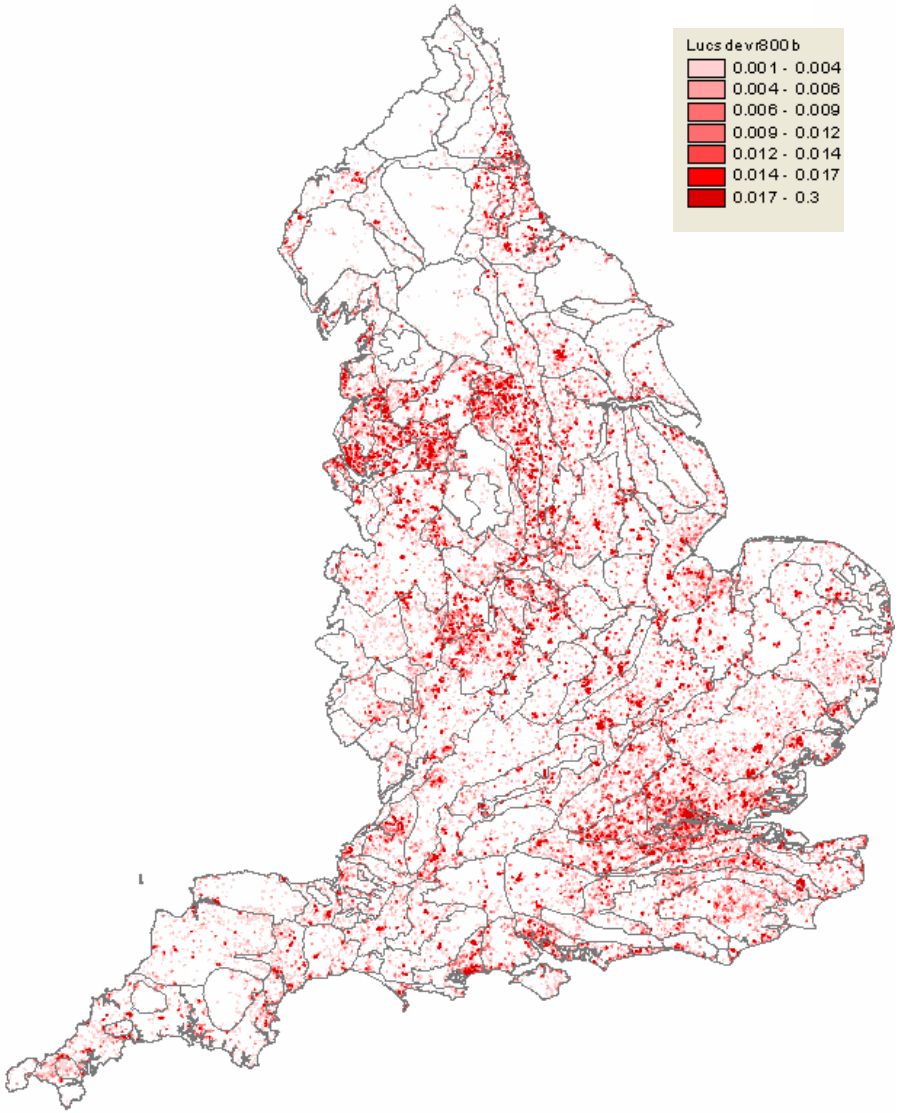
2.16 Previous assessments of LUCS (Bibby and Coppin, 1994; Bibby 2000) have suggested that data quality is high, particularly for changes to residential use (although considerable attention has been devoted to the length of time that might typically elapse before a change is recorded by OS (Bibby and Shepherd 1997)). Such assessments may require some revision given changes in operational procedures used by OS contractors. (Some difficulties in relation to the recording of change from woodland are found in Appendix Four).

2.17 In producing the grids discussed above, some basic tests of the plausibility of changes recorded in LUCS have been undertaken. In the case of changes to residential use, LUCS records both the area of land developed (or re-developed) and the number of units built. For the purposes of CQC of course, the amount of land passing to residential use and particularly the area of land being converted from open to built uses is more important than the numbers of units constructed. Nevertheless, LUCS information about the numbers of units built may serve as both a check upon and a supplement to information about amount of land being developed for housing.

Figure 2.2: LUCS Development Grids, Smoothed at 800 metres

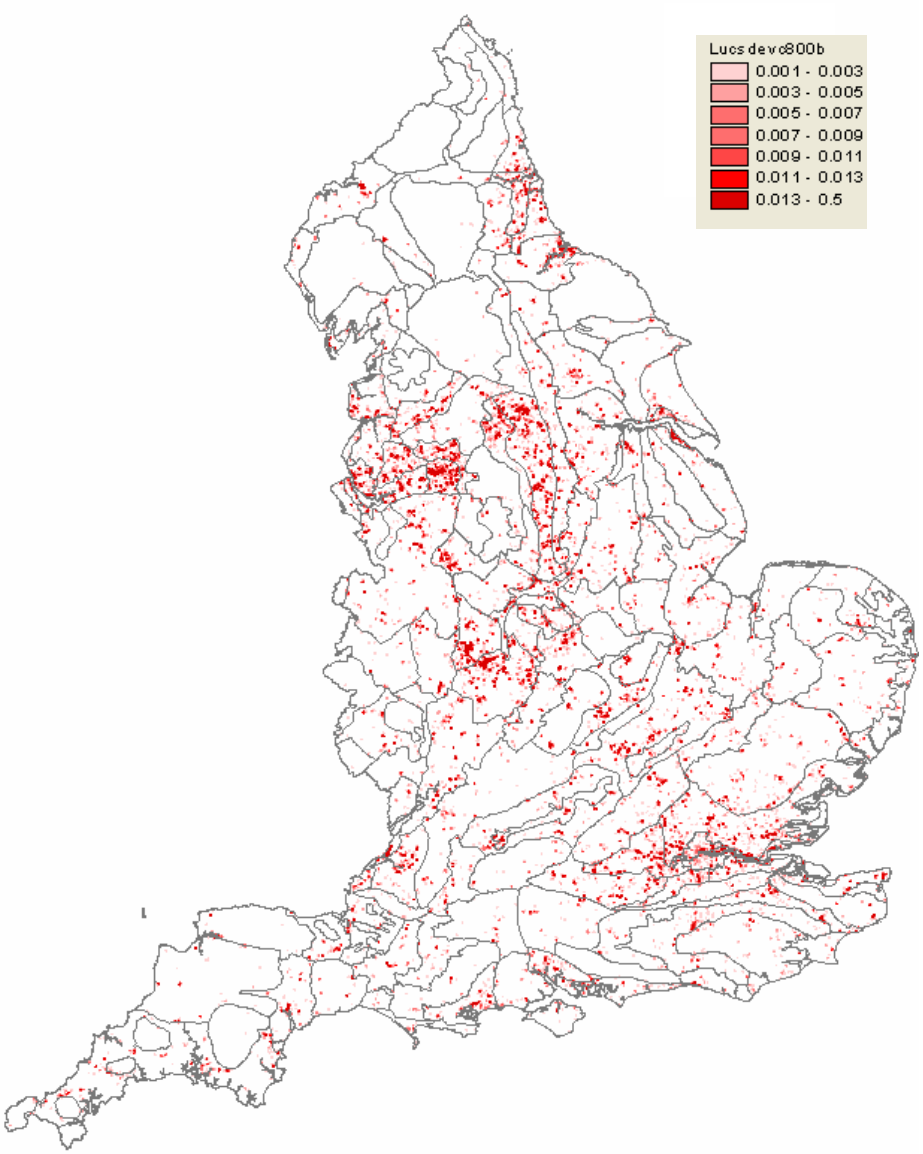


a) Lucsdev800 (all development)

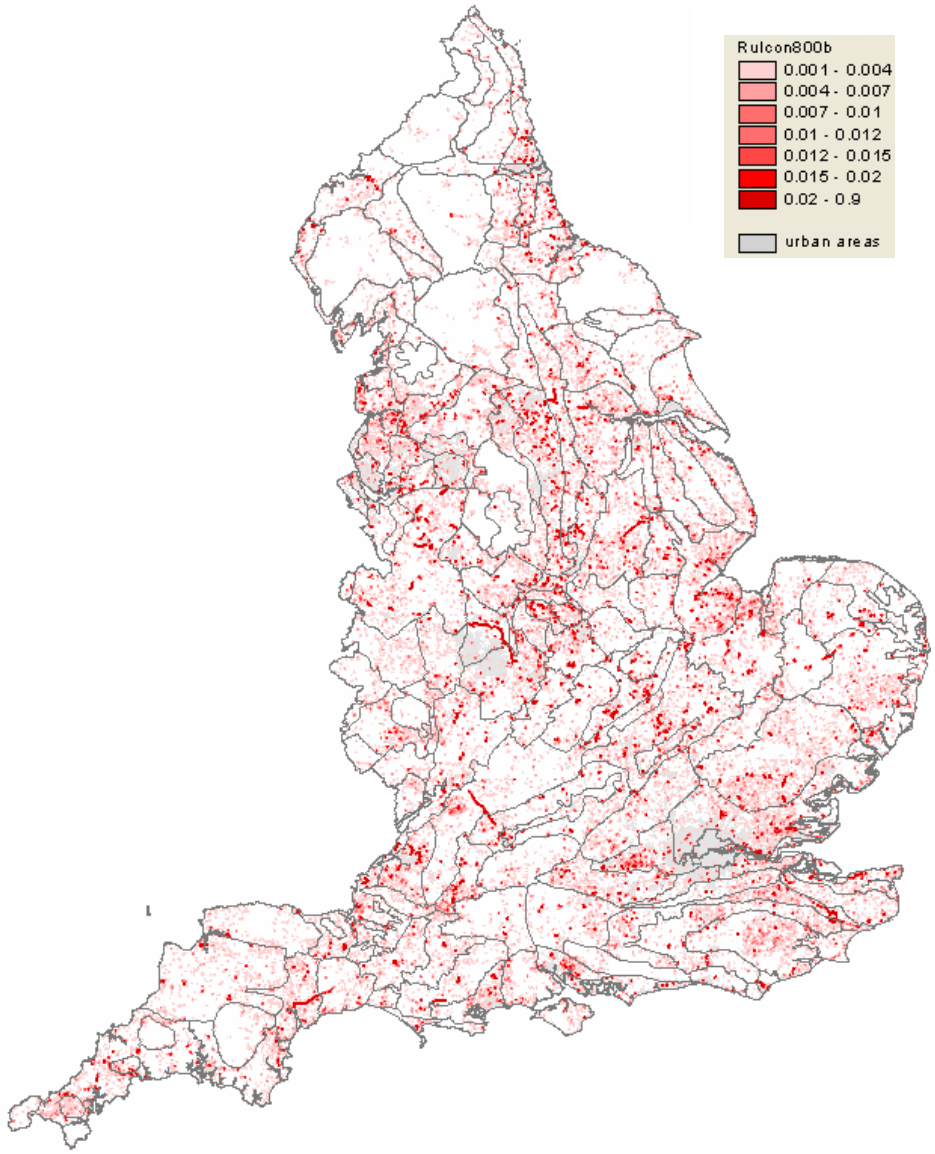


b) Lucsdevr800 (all residential development)

Lucsdev 800 shows in increasing intensity of red the proportion of each hectare tile that was developed or redeveloped for any built use between 1998 and 2003. Lucsdevr 800 shows the corresponding proportion with a residential final use. Values shown are averaged over an 800m radius.

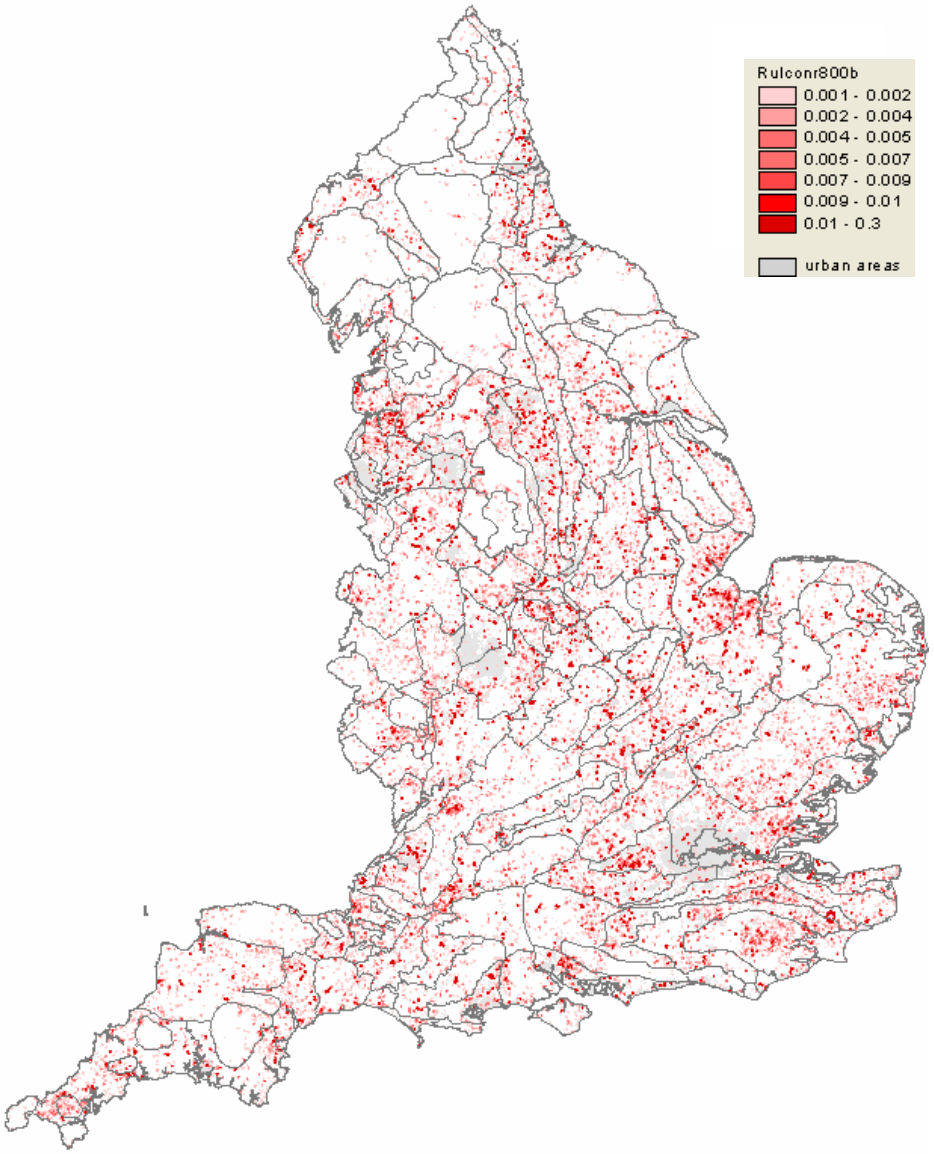


c) Lucsdevc800 (all industrial and commercial development)

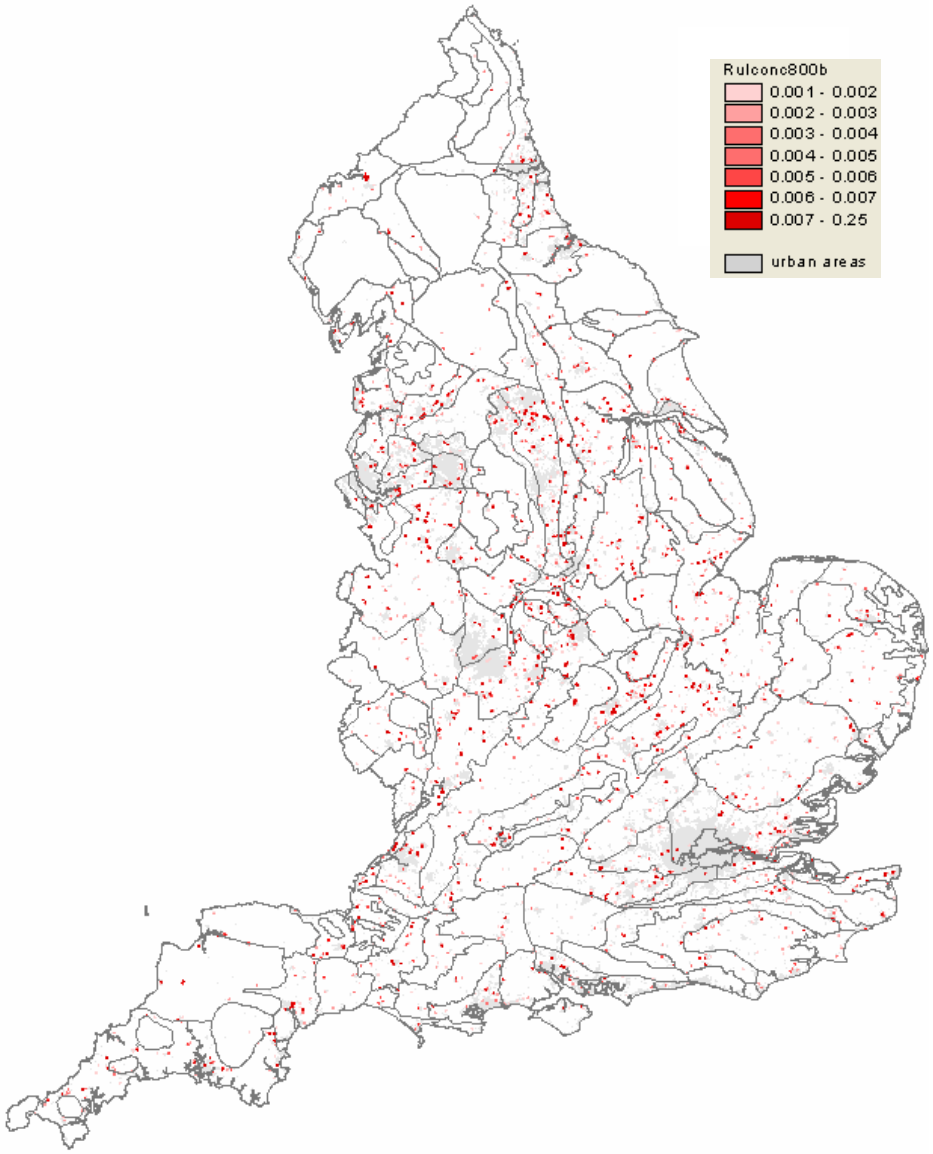


d) Lucsrulcon800 (rural to urban land conversion – all uses)

Lucsdevc 800 shows in increasing intensity of red the proportion of each hectare tile that was developed or redeveloped between 1998 and 2003 for industrial or commercial purposes. Lucsrulcon800 similarly shows the proportion of each hectare tile that was developed for any built use in those years involving loss of greenfield land. Values shown are averaged over an 800m radius.



e) Lucsrulconr800 (rural to urban land conversion – for residential use)



f) Lucsrulconc800 (rural to urban land conversion – for industrial and commercial use)

Lucsrulconr800 shows in increasing intensity of red the proportion of each hectare tile that was developed for residential use between 1998 and 2003 involving loss of greenfield land. Lucsrulconc800 similarly shows the proportion of each hectare tile that was developed for industrial or commercial use involving loss of greenfield land. Values shown are averaged over an 800m radius.

Newly Built Dwellings: the Evidence of LUCS

2.18 Before introducing further analyses, it may be useful to consider the **Lucsrunits** grid (see Figure 2.3) which shows the distribution of newly built dwellings (as distinct from residential land). It is constructed from LUCS in a manner directly analogous to the six grids discussed above, but represents units of accommodation.

2.19 Generally, the distribution of housing units encapsulated within this grid tracks the distribution of housing land discussed above. Divergences reflect variation in residential density. Place-to-place variation in the apparent density of new development at the urban fringe is modest (reflecting high levels of standardization by volume housebuilders, the application of central government planning policy guidelines by local planning authorities, and OS estimation procedures). There is, however, marked variation between different settlement contexts, with very low development densities in the broader countryside (See Table 2.2).

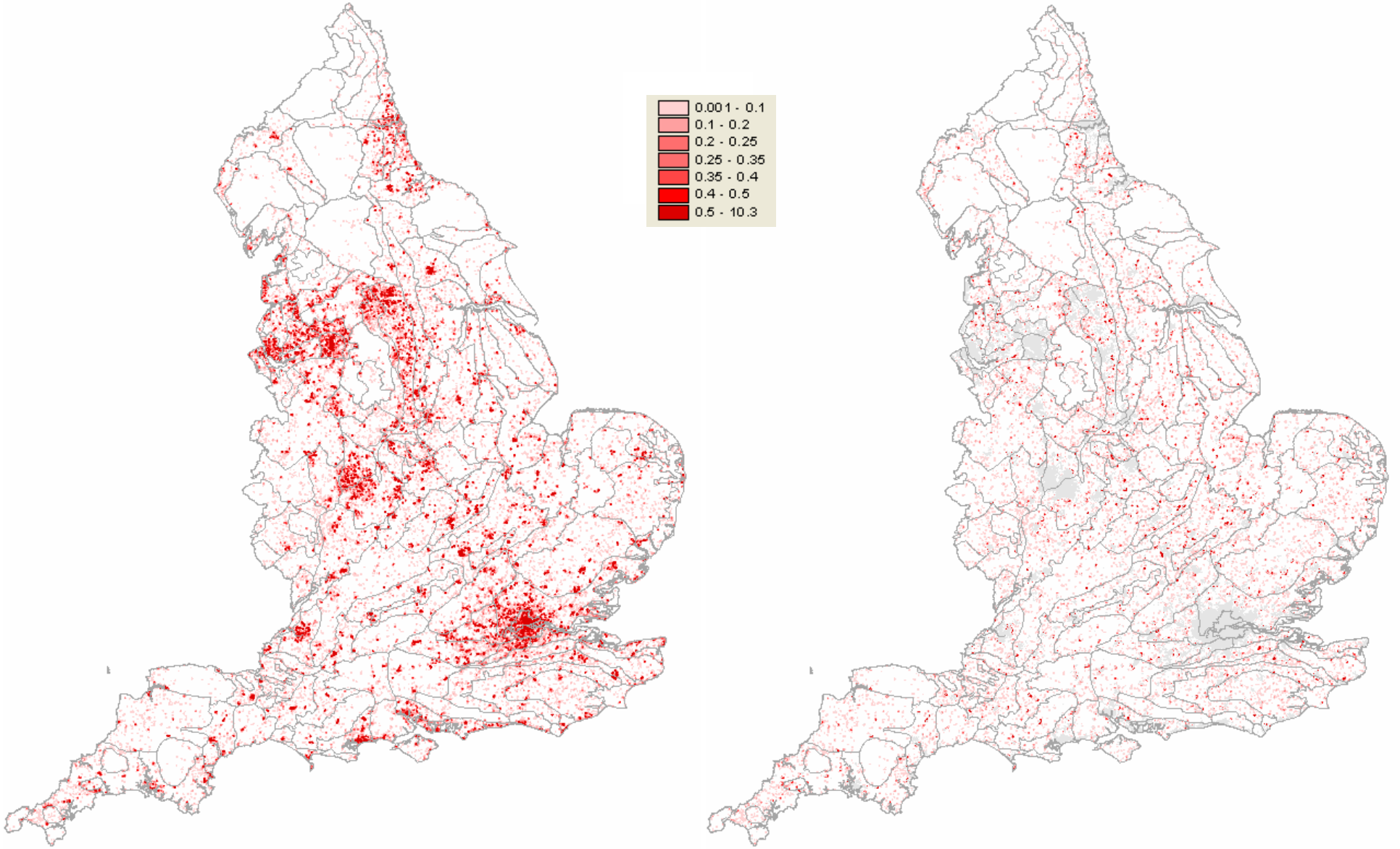
Table 2.2: Housing Units and Housing Land Developed 1998-2003 by Settlement Type

	Units	Land	Density
Urban 10k	506000	15815	32.00
Town	92975	3969	23.42
Fringe	60213	2715	22.18
Village	45899	3261	14.08
Peri-urban	56462	3691	15.30
Village envelope	26419	2035	12.98
Hamlet	1208	281	4.30
Isolated farm	1310	317	4.13
Other	19205	4007	4.79
Total	809690	36090	22.44

2.20 Figure 2.2b and 2.2e draw attention to areas where the area of *land* passing into residential use seems surprisingly high. Two such areas are Herefordshire and the margins of the Wash. Both areas are known to have low residential densities. (When the scale of housing development is gauged by reference to numbers of units rather than areas of land, these two apparently anomalous areas of housing growth become far less pronounced). Nevertheless, densities recorded seem extremely low relative for example to development densities in these same areas in the 1990s. There must therefore be some concern that LUCS may over-record the amount of land passing into residential use in these circumstances or under-record the number of units built.

2.21 The particular case of Herefordshire is considered in more detail in Appendix Two. The Appendix draws attention to the possibility that low densities may be recorded where the curtilage of existing residential properties is extended and considers such tendencies in other areas. Detailed examination thus shows how extremely low densities may arise, but does not in itself provide adequate reason for believing that the areas of land or the numbers of units are improperly recorded in these particular circumstances. It is, of course, important to appreciate that reference to areas of land alone is likely to give a misleading impression of likely visual intrusion.

Figure 2.3: Lucsrunits800, Housing Units Built (units per hectare)



a) For England

b) English rural domain only

Figure 2.3a shows in increasing intensity of red the number of new dwellings built in each hectare tile between 1998 and 2003. Figure 2.3b shows similar information bur excludes urban areas with a population of 10,000 or more.

2.22 For present purposes, data involving change to residential use have been subjected to two checks; the first being based on the implied density of development, the second on the relation to change recorded in PAF. It should be stressed, however, that the aim has been solely to allow erroneous data to be set aside where there is clear evidence both that recorded change is not feasible and that inclusion of the data might lead to significant errors of substantive interpretation.

2.23 The density test involved identifying all LUCS 'events' where the implied dwelling density exceeded 100 units to the hectare. (While such densities may be plausible in the densest urban areas, they are clearly questionable elsewhere). LUCS includes 1,827 events with residential development at such densities (1.02% of residential LUCS events). Of these, 1,655 fall inside urban areas as of 2001 (defined by OS for ODPM) and hence are unlikely (even if correct) to signal shifts in landscape character of major concern for purposes of the *Countryside Quality Counts* project.

2.24 The remaining 172 events include 155 where the reported number of units built is 30 or less. While considerable doubt must attach to these records, it seems unlikely that they would signal a change from rural to urban character (in the sense of Government's urban and rural definitions). While they point to signal local landscape change, as these 155 events are scattered over 11.4 million hectares it seems unlikely that they would have a material effect on the interpretation of conditions in any particular Joint Character Area (JCA). There therefore seems little case for removing them from the data.

2.25 On this basis, 17 LUCS events remain as possible candidates for exclusion. Having examined the sites (many of which are at the urban fringe) there seems to be no unequivocal basis for deleting the records and in view of their small number they have been retained.

2.26 The second approach to testing the general plausibility of the LUCS data involves comparing the number of dwellings built in the years 1998 to 2003 (recorded on LUCS) with the net change in residential units over the period (implied by PAF). Although in principle this provides an obvious basis for assessing whether LUCS might under-record new construction, the relationship between new construction and net change is less straightforward than might be assumed and similar analyses at a detailed level have not been undertaken previously. Understanding this relationship proves important in grasping the role of the countryside in accommodating additional households, and it is discussed from this perspective in Section 3.

2.27 For immediate purposes, the aim is to use the relationship between building and net change in dwellings to investigate the possibility that LUCS might under-record development at the urban fringe. Net change in dwellings depends not only upon the upon the number of units built, but also on the number gained through conversion of existing property (less adjustments for demolitions and losses of units through amalgamation of properties).When net change in PAF is compared directly with the number of units built on LUCS, other components of change are conflated into a residual, termed here G, representing the net gain in dwelling units per hectare not involving new construction. Possible values of G are discussed in Appendix Three. On the basis of that discussion it is argued that values of G in excess of one unit per

hectare at the urban fringe are intrinsically implausible. Areas where such implausible relationships are found are mapped in Figure 2.4 and tabulated in Appendix Three.

2.28 It is not possible directly to adjust the LUCS records to compensate for possible under-recording. Some expansion of the contiguous urban area may thus be under-represented in the grids included in this section. Nevertheless, most new building at the edge of urban areas will involve the laying out of new streets, and such development can be found by examining change in the Postcode Address File (PAF). In Section 3 a grid is created (**Nstreetgrowth**) which attempts to capture the footprint of property served by new streets. Using the grids discussed in this chapter and that latter grid in combination, it should be possible to offset any tendency of underestimation of urban expansion.

Transport infrastructure and development at the urban fringe

2.29 Before leaving the evidence of LUCS, it may be useful to examine how these patterns of land conversion it reveals relate to the detail of urban form and the nature of transport infrastructure. For this purpose development units may be characterised by reference to the configuration of transport infrastructure which serves to focus development pressure in a manner which may support or (in areas of restraint) challenge public policy. A grid has been generated (**Facets_all**) which categorizes hectare tiles in terms of their relation to strategic road junctions, and to existing urban areas and transport routes.

2.30 The construction of the grid depends upon the prior construction of a mosaic partitioning the country into 'facets' defined by main roads (as defined by Meridian II) and urban area boundaries (digitised for ODPM by Ordnance Survey for use with the 2001 Census). In the mosaic illustrated in Figure 2.5, an edge may be either a stretch of road or the limit of an urban area. Each facet has subsequently been classified in terms of its size, elongation and the class of its boundaries (all roads; road and urban etc), and this classification has then been transferred to the hectare tiles. The approach allows amongst other things the identification of infill development between urban areas and by-pass roads.

2.31 Specification of the characteristics of each facet has been achieved by first characterising each of its edges and then summarising the characteristics of the facet itself. Each edge is represented in a record of the following form:

ifo(roadurb,Fnode,Tnode,Lfacet,Rfacet,Length,Id1,Id2,Lfacet2,Rfacet2,Urbflag,Id3,Roadcode,Linetype).

Thus, a stretch of the A6136 running through a rural tract might be represented as:

ifo(roadurb,21444,21468,3257,3258,434.6,24605,183880,[ ],[ ],0,183880,[a6136],[a]).

while a section of the A591 running through the town of Windermere is represented as:

ifo(roadurb,21461,21469,3265,3266,132.6,24606,183865,[windermere],[windermere],0,183865,[a591],[a]).

2.32 Within this representation, the urban edge is found where a particular segment has an urban facet to one side but not to the other:

```
ifo(roadurb,4366,4369,406,409,787.3,4724,6715,[berwick-upon-
tweed],[ ],1,0,[0],[0]).
```

Figure 2.4: Place to Place Variation in G (For explanation see para 2.26)
G greater than 1 (red) or less than -1 (blue), for the rural domain only.

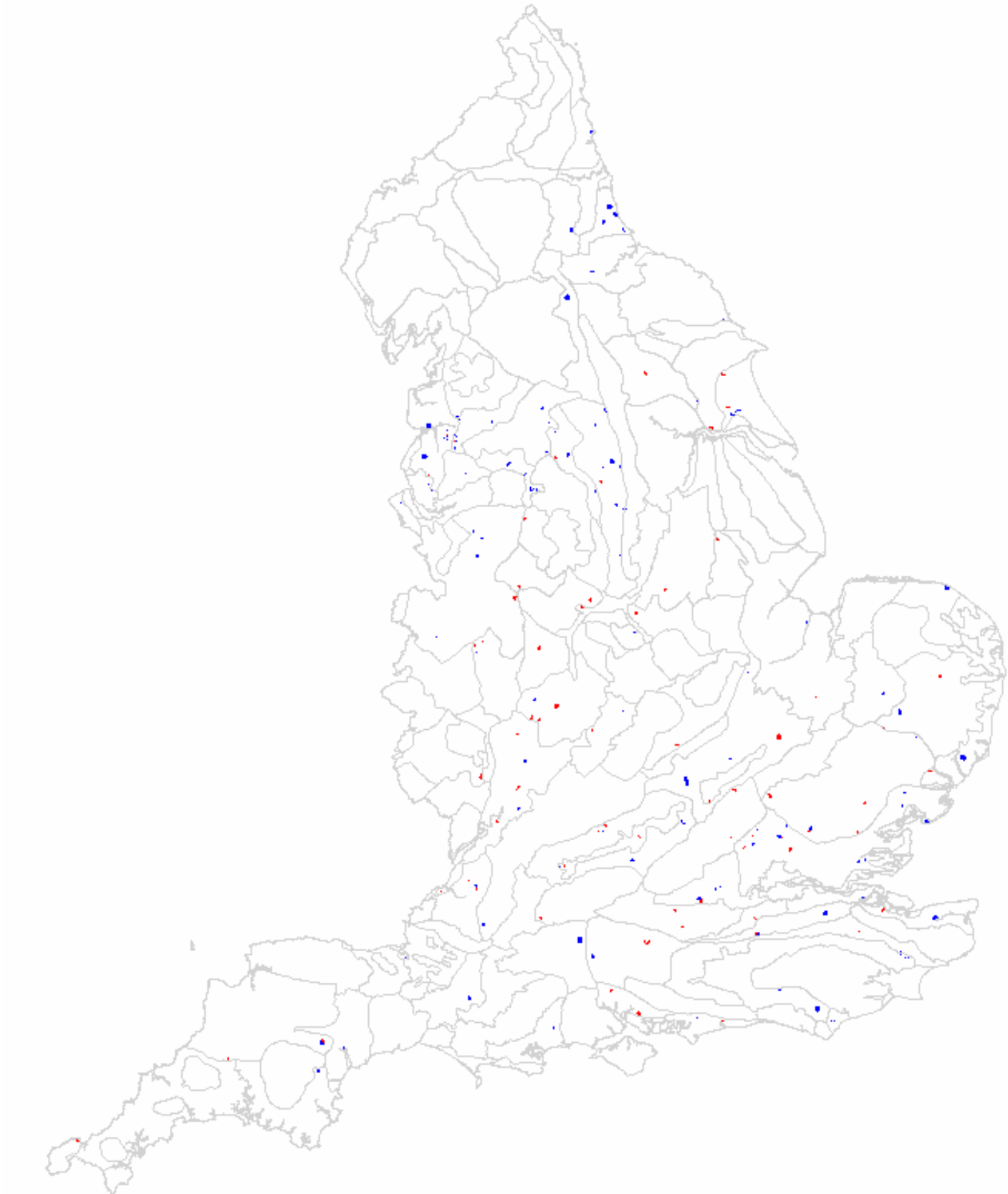


Figure 2.5: Road and Urban Facets

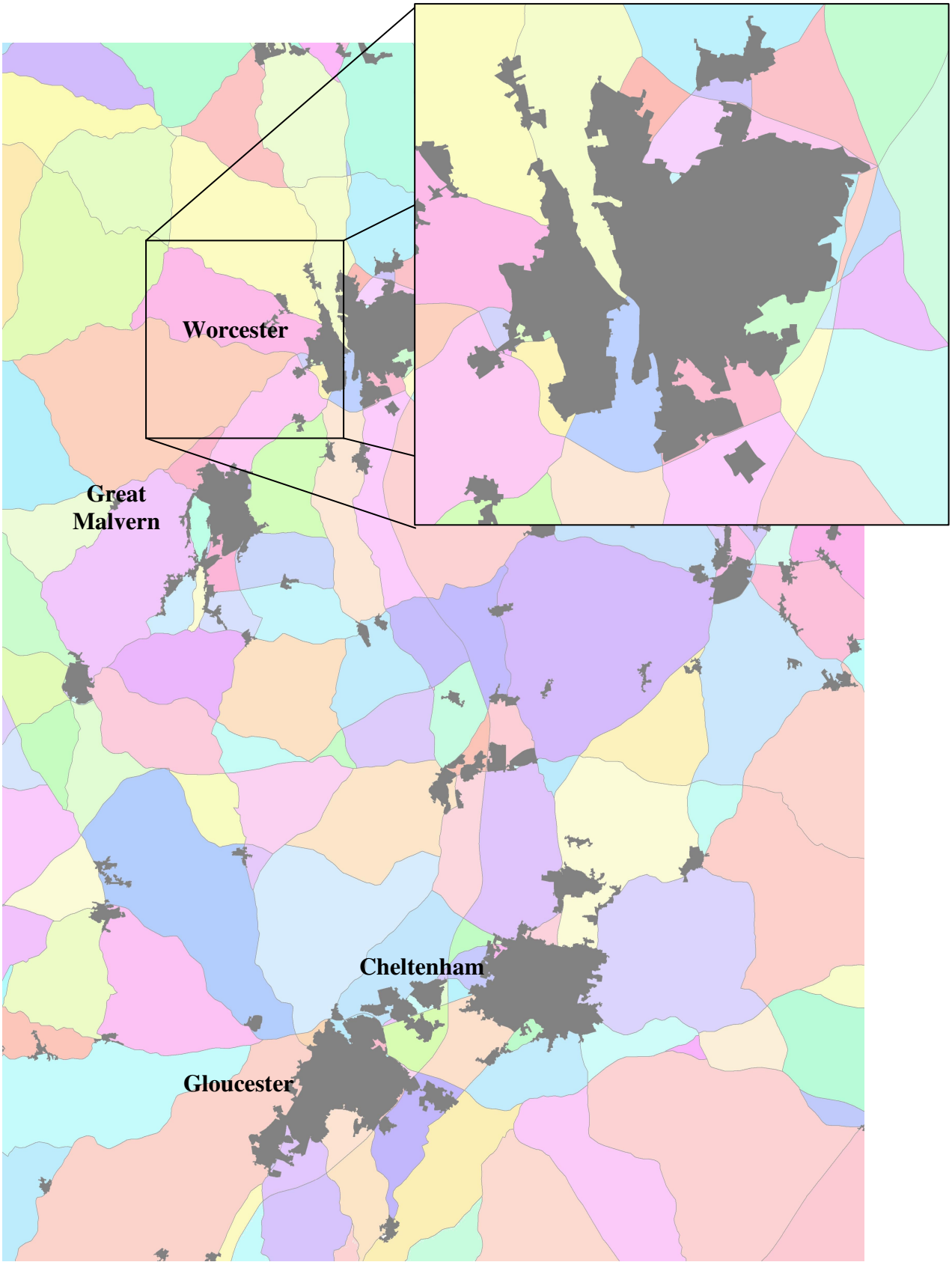
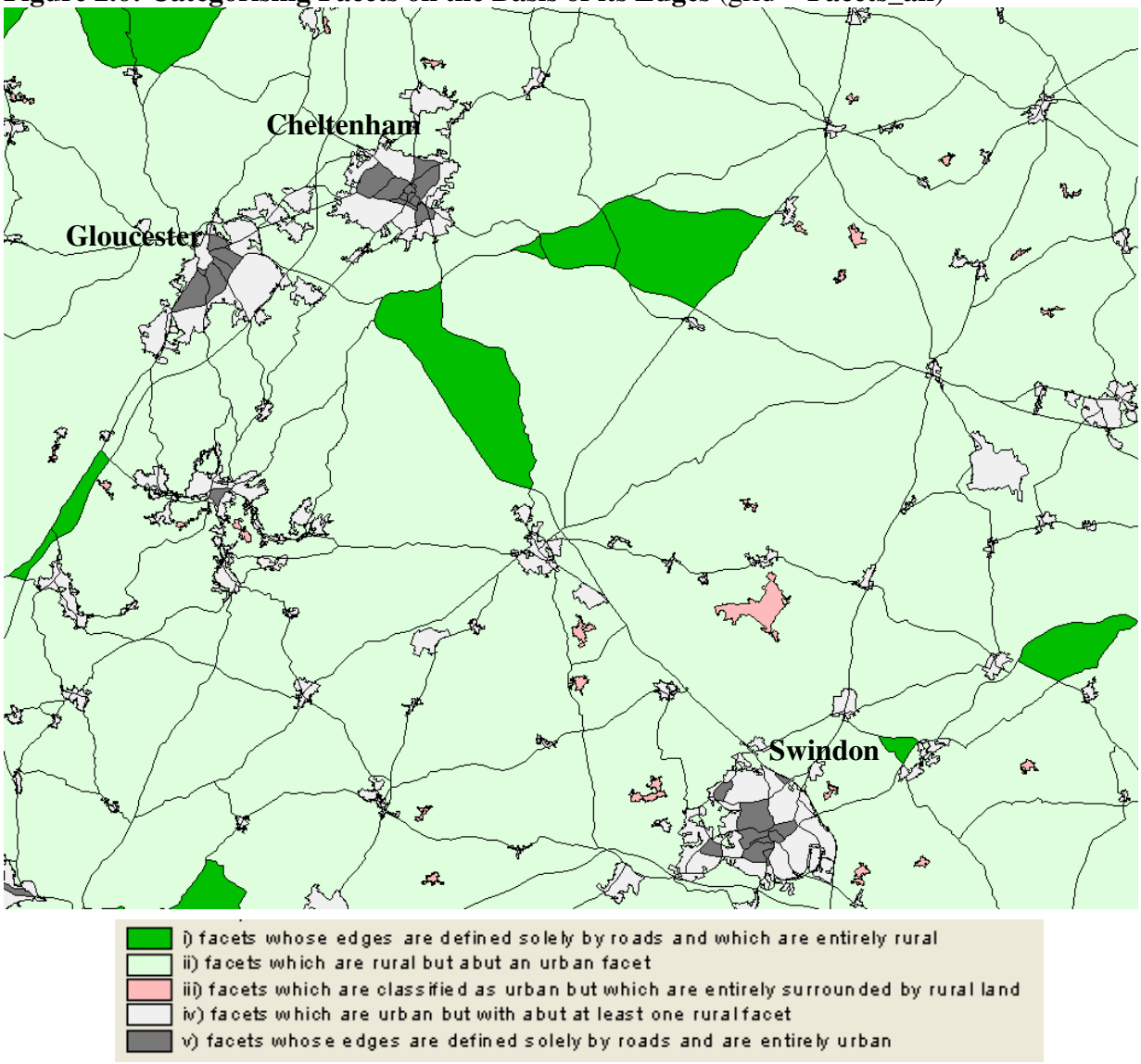


Figure 2.6: Categorising Facets on the Basis of its Edges (grid = **Facets_all**)



2.33 On the basis on the information recorded for the line segments, the characteristics of the facets themselves can be inferred. A polygon to the right of an urban area boundary falls within that urban area, and so on. In this way (see Figure 2.6), facets have been grouped into five categories:

- i) facets whose edges are defined solely by roads and which are entirely rural
- ii) facets which are rural but abut an urban facet
- iii) facets which are classified as urban by OS but which are entirely surrounded by rural land (for example villages without major roads)
- iv) facets which are urban (as defined by OS) but with abut at least one rural facet
- v) facets whose edges are defined solely by roads and are entirely urban

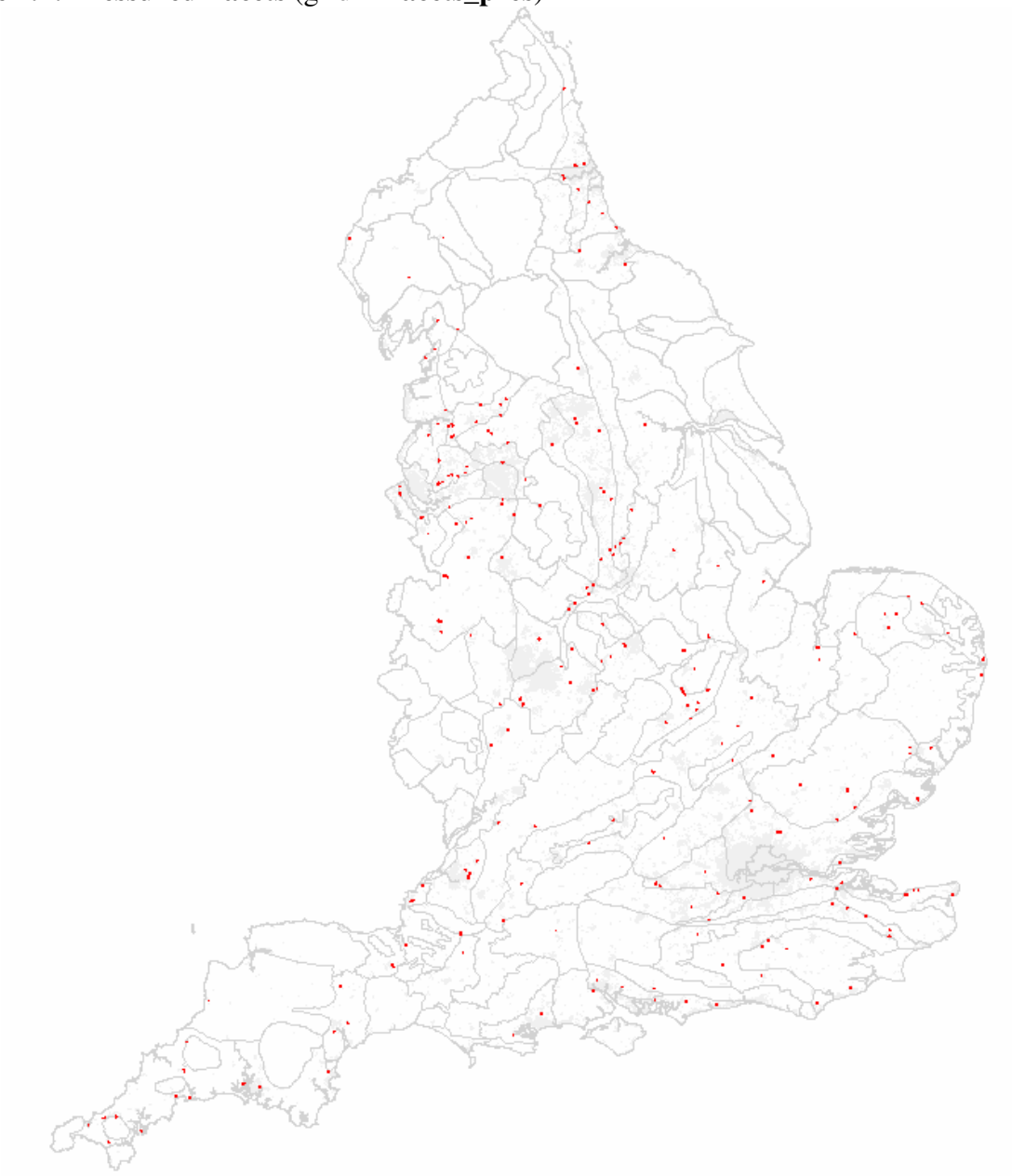
2.34 It is those facets in category (ii) that represent land lying between urban areas and a major road. From the perspective either of the market or planning system, potential for development will be increased where land is relatively close to the urban area. A facet sharing a substantial part of its boundary with an urban area, and also bounded

in part by a similar length of major road might be seen by some as a as a ‘natural’ extension of the urban area.

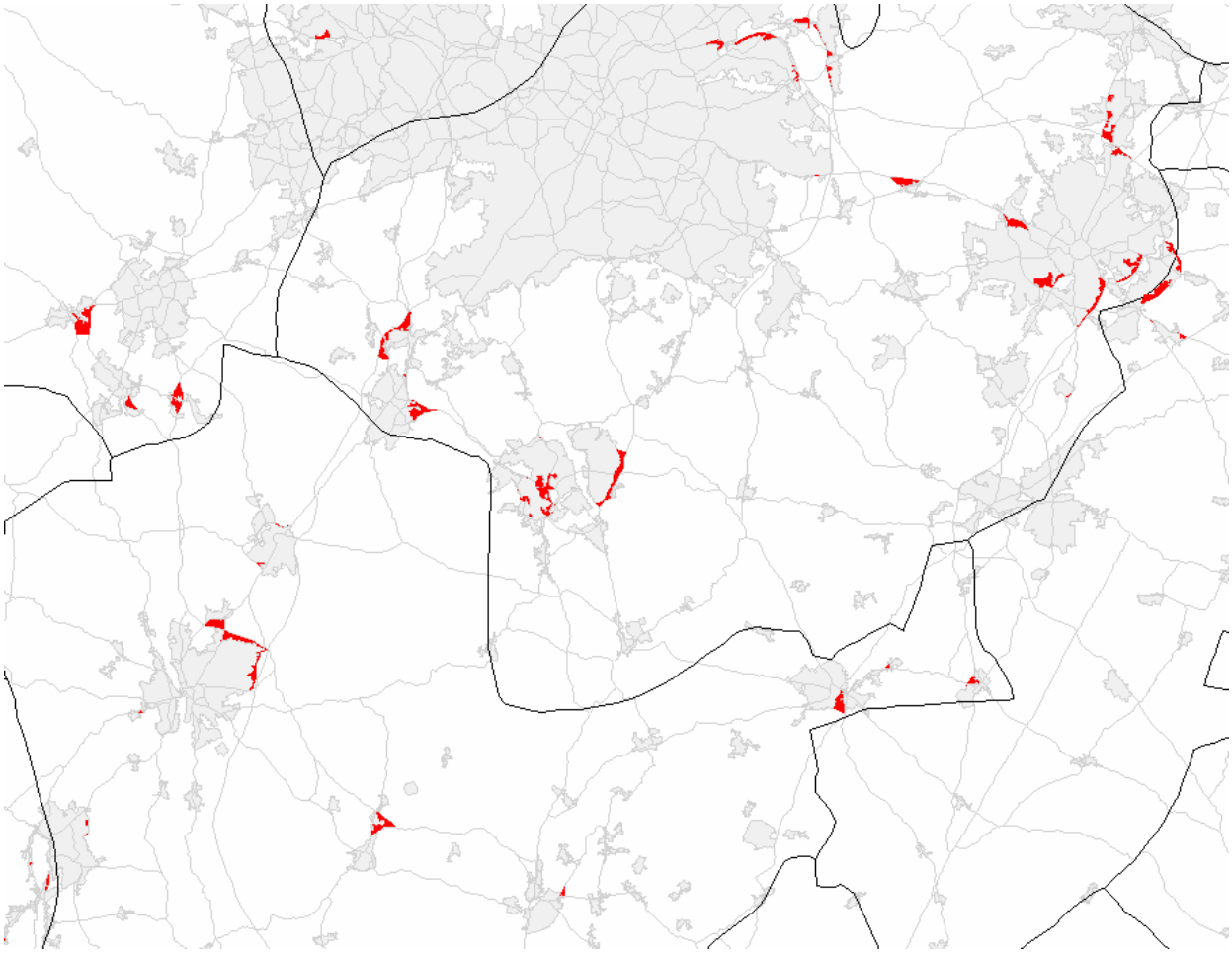
2.35 Simple rules can be used to identify category (ii) facets where the chance of such developments seem highest, referred to as ‘pressured facets’. Figure 2.7 highlights category (ii) facets where:

- i) the urban rural boundary accounts for at least twenty percent of the perimeter of the facet but less than eighty percent
- ii) the ratio of the urban-rural boundary of the facet to the length of road defining edges of the facet must be greater than 0.2 and less than 0.8
- iii) the area of the facet must be at least one hectare and under sixty hectares
- iv) the elongation factor of the facet must be between 1.5 and 3.5

Figure 2.7: Pressured Facets (grid = **Facets_pres**)



a) for England



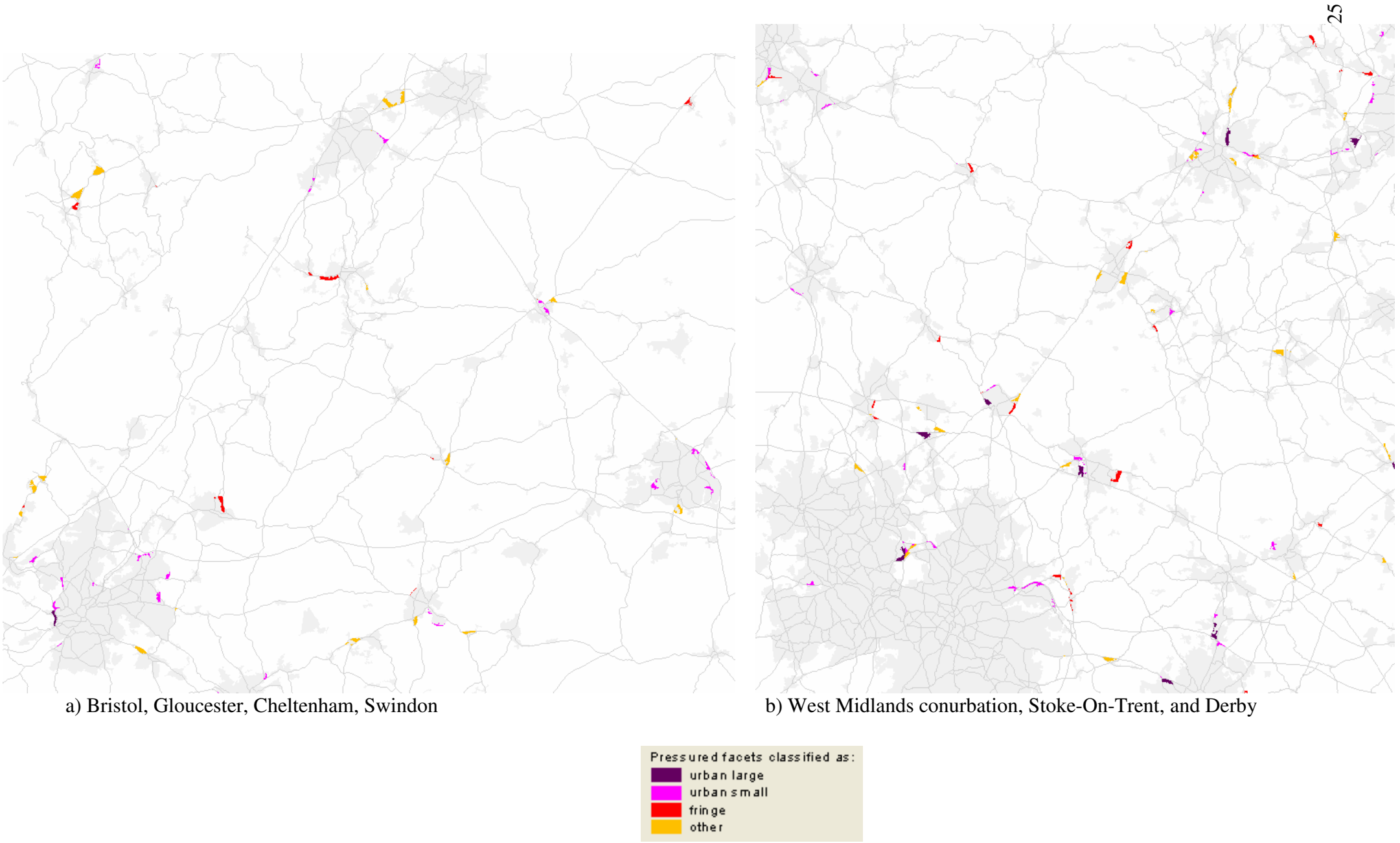
b) To the south of the West Midlands conurbation

2.36 Pressured facets that meet the criteria could be further categorized using the settlement classification to capture their status in 2001 as shown in Figure 2.8:

- i) large urban (urban, site size over 30 hectares, n=123)
- ii) small urban (urban, site size under 30 hectares, n=569)
- iii) fringe (fringe, n=407)
- iv) other (other settlement categories, n=670)

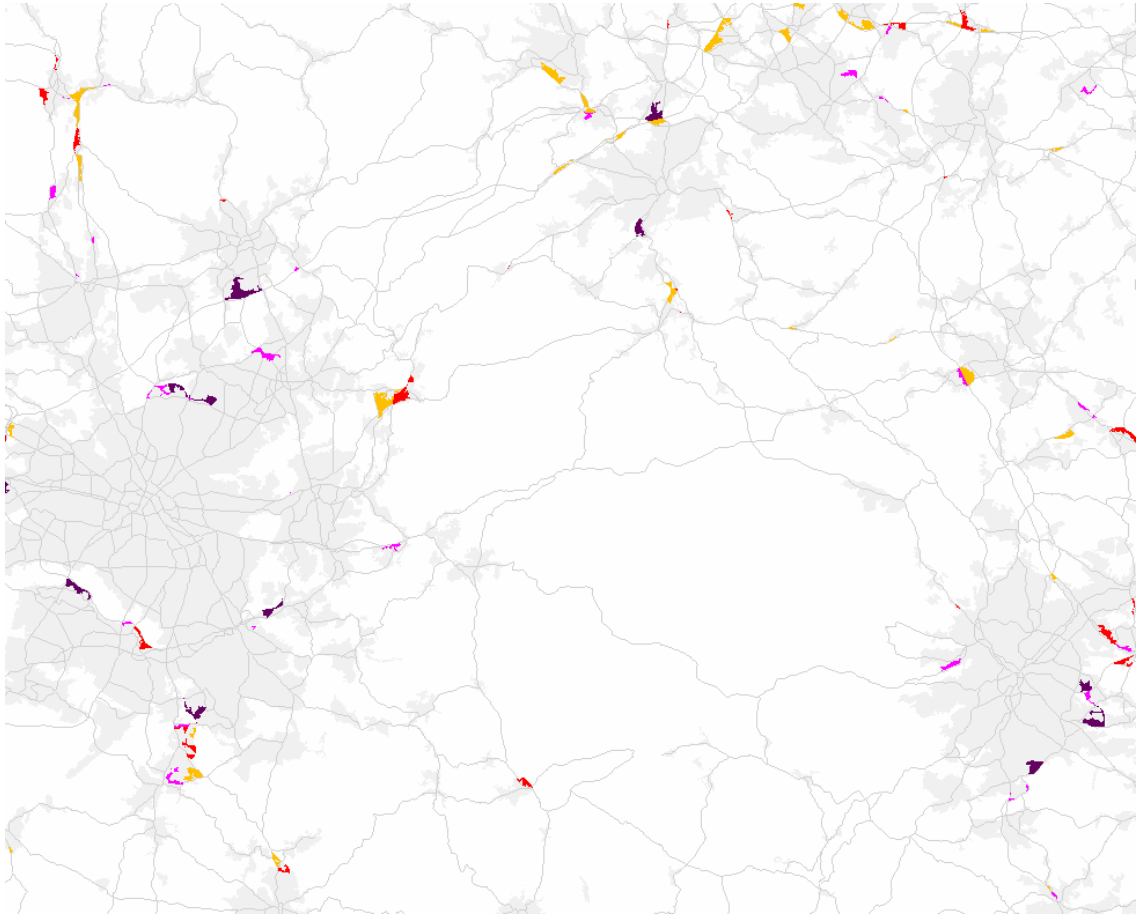
2.37 Having established on this basis a grid encapsulating the location of each facet relative to urban areas and transport infrastructure, it is possible to examine differential tendencies to land conversion. Overall, between 1998 and 2003, 1.17% of the area of pressured facets was converted from greenfield to developed uses. This represents a rate 13.6 times higher than that which prevailed across the country as a whole. The rate was highest in facets on the very edge of the urban area which are less than 30 hectares in extent (16.16 times higher than typical of the country as a whole). Table 2.3 indicates pressured facets of more than five hectares at least ten percent of whose area was converted from greenfield to developed use in the period 1998-2003.

Figure 2.8: Classification of Facets by Settlement Type (grid = **Facets_presm**)



a) Bristol, Gloucester, Cheltenham, Swindon

b) West Midlands conurbation, Stoke-On-Trent, and Derby



c) Manchester, Huddersfield Sheffield

d) Leicester, Peterborough, Northampton, Milton Keynes

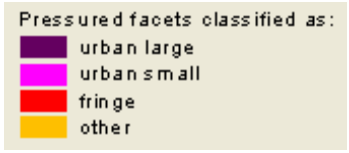


Table 2.3: Pressured Facets Larger than Five Hectares with Over Ten Percent of Area Converted from Greenfield to Developed Use, 1998-2003

Area converted from greenfield to developed (Pct)	Facet size (hectares)	Greenfield development (hectares)	Adjoining urban area	Joint Character Area
67.61	9	6.09	Downham Market	The Fens
59.67	6	3.58	Kirton (Boston)	The Fens
53.19	18	9.58	Billingshurst	Low Weald
41.79	14	5.85	Normanton South	Nottinghamshire, Derbyshire and Yorkshire Coalfield
40.00	6	2.40	Whitstable	North Kent Plain
36.38	22	8.00	Westbury	Avon Vale
32.11	19	6.10	Denver	The Fens
30.83	9	2.78	Sutton in Ashfield	Sherwood
30.14	18	5.43	Mangotsfield	Bristol, Avon Valleys and Ridges
30.00	9	2.70	Whitstable	North Kent Plain
27.00	11	2.97	Aylsham	Central North Norfolk
25.90	10	2.59	Camborne / Redruth	Cornish Killas
23.85	44	10.50	Weston-Super-Mare	Somerset Levels and Moors
23.75	8	1.90	Ashford	Wealden Greensand
22.51	36	8.10	Saltash	Cornish Killas
20.00	5	1.00	Forest Row	High Weald
18.89	26	4.91	Rotherham	Nottinghamshire, Derbyshire and Yorkshire Coalfield
17.58	40	7.03	Wellingborough	Northamptonshire Vales
17.43	50	8.71	Shrewsbury	Shropshire, Cheshire and Staffordshire Plain
15.00	14	2.10	Crawley	High Weald
15.00	6	0.90	Derby	Needwood and South Derbyshire Claylands
15.00	5	0.75	Harrogate / Knaresborough	Pennine Dales Fringe
14.85	43	6.39	Long Benton / Killingworth	South East Northumberland Coastal Plain
14.82	35	5.19	Reading	Thames Valley
14.41	31	4.47	Kingswood	Bristol, Avon Valleys and Ridges
14.21	19	2.70	Buckingham	Bedfordshire and Cambridgeshire Claylands
14.14	7	0.99	Camelford	Bodmin Moor
13.96	12	1.68	Kettering	Northamptonshire Vales
13.64	11	1.50	Welwyn Garden City	Northern Thames Basin
13.37	50	6.68	Coalville	Leicestershire and South Derbyshire Coalfield
13.19	27	3.56	Lowestoft / Corton	Suffolk Coast and Heaths
13.06	36	4.70	Waltham Abbey	Northern Thames Basin
12.94	21	2.72	Shepton Mallet	Mendip Hills
12.66	8	1.01	Great Malvern	Severn and Avon Vales
12.22	9	1.10	Sheffield	Nottinghamshire, Derbyshire and Yorkshire Coalfield
12.22	9	1.10	Worksop	Sherwood
12.00	5	0.60	Rochdale	Southern Pennines
11.64	47	5.47	Bromsgrove	Arden
11.41	23	2.63	Ellesmere Port	Shropshire, Cheshire and Staffordshire Plain
11.39	36	4.10	Chorley	Lancashire Valleys
11.33	15	1.70	Wilmslow	Shropshire, Cheshire and Staffordshire Plain
11.15	12	1.34	Bodmin	Cornish Killas
11.11	9	1.00	South Normanton / Pinxton	Nottinghamshire, Derbyshire and Yorkshire Coalfield
10.88	17	1.85	Macclesfield	Shropshire, Cheshire and Staffordshire Plain
10.87	15	1.63	Selston / Underwood / Brimsley	Southern Magnesian Limestone
10.77	26	2.80	Kettering	Rockingham Forest
10.55	11	1.16	Camborne / Redruth	Cornish Killas
10.07	19	1.91	Cirencester	Cotswolds

3. Settlement and Development 1998-2003: Grids from the Postcode Address File (PAF)

Overview

Using PAF and LUCS together it is possible to appreciate both the extent of new building and the rather different pattern of net change in dwelling stocks. Between 1998 and 2003, the stock of dwellings in the rural domain increased by 5.9%, compared with 2.2%, in the urban domain and 3% across England as a whole.

The impact of this growth is not reducible to 'urban sprawl'. Three houses in every five were accommodated *within* the urban domain, and just one new dwelling in seven was built at the urban margin (in the 'fringe' and 'periurban' zones of the 2001 settlement typology). Even this overstates the impact of new housebuilding on expansion of the *contiguous* urban area. Two new indicators of residential growth at the urban fringe were developed for this project. New indicators based on PAF and LUCS were also developed to gauge new non-residential development at the urban fringe, and charting the growth of new property objects such as 'retail parks'. This section tabulates these indicators at JCA level, together with a composite indicator of urban expansion. The various indicators highlight the extent of new business and leisure development on the fringe of medium sized towns, usually associated with policy driven growth.

The broader countryside beyond the urban fringe has not been left unaffected, at least in terms of residential development. In absolute terms, it has accommodated far more newly built dwellings and seen a greater net increase in the dwelling stock than has the urban margin. In some JCAs such as the Bedfordshire and Cambridgeshire Claylands new building alone has driven substantial increases in dwelling stock. Far less commonly, conversion activity has *combined* with new build to generate substantial increases in dwellings as in the Vale of York and Vale of Pickering JCAs. Elsewhere, especially in areas of marked planning restraint, conversions *alone* have yielded relatively significant increases in dwellings).

Particular localities within the broader countryside have shown a high degree of settlement intensification. This has been particularly marked in hamlets and isolated farms, where gains from conversion and subdivision have exceeded that of new building by a factor of four. Numbers of residential 'barn' properties within hamlets increased by more than 50%.

Only some JCAs, however, showed any tendency to settlement intensification. Many tracts of upland of high landscape quality showed no such tendency. Rural settlement intensification seems to have been most marked in three circumstances. First, in JCAs that adjoin some of the northern and midland conurbations, especially in areas historically characterized by dispersed settlement. A second circumstance is in the rural environs of planned growth centres. The third set of circumstances have to be understood in terms of accessibility to more distant locations in road and rail corridors and at a considerable distance from London.

3. Settlement and Development 1998-2003: Grids from the Postcode Address File (PAF)

3.1 This section is concerned with the types of inference about development both at the urban fringe and within the broader countryside that may be derived from PAF. PAF is potentially a very rich source of information about physical development and changing settlement. It is not a statistical source in any usual sense, but rather a list of postal addresses, supplemented by grid references and in the case of non-residential property by occupier names. It has the advantages of being collected for the entire country in a standard format, of being frequently updated, and of being modestly priced. *Conceptually* the processing of PAF is simple: property is indexed by postal addresses; inferences can be made about the property from the address (eg Flat 4; is part of a property and not a whole; St Mary's Church is a religious building).

3.2 Comparison of data drawn from versions of PAF for different periods allows inferences to be made about change. PAF may thus form the basis for highly detailed examinations of land use and of property utilisation. Potentially such comparisons expose changes arising from conversion which are rarely revealed within LUCS. Moreover, as amply illustrated later in this section, PAF's usefulness is enhanced by combination with other datasets. Nevertheless, it cannot be emphasised too strongly that the computation needed to derive such insights is substantial in scale, and the natural language processing required to draw inferences about property and about change is highly complex. It should be remembered that all PAF yields *directly* is a postcode, a grid reference, addresses of the associated properties (in three groups residential non-residential and large), the number of delivery points in each class, names of non-residential occupiers and a set of locational tags.

3.3 This section has the threefold aim of setting out the nature of the grids generated for PAF for the *Countryside Quality Counts Project*; highlighting some of the substantive changes which they reveal and providing an appreciation of the methods used to generate them. These aims are met by introducing analyses of PAF broadly in order of complexity, thus progressively nuancing the discussion of development patterns.

3.4 The most straightforward analyses developed depend on simply noting changes in the *number* of delivery points included on PAF. A delivery point is a location such as a house, flat, shop or business to which Royal Mail delivers letters. While the units of occupation (households or dwellings) indexed by residential delivery points are relatively similar in character, non-residential delivery points vary very substantially (a mailing address; a kiosk in a bus station, an upstairs office, a shop unit, a unit on an industrial estate and so on). It is therefore possible to draw useful inferences about settlement and development simply by looking at the geographic distribution of addresses, but it is not helpful to look at all *types* of addresses together.

3.5 Given that housebuilding predominates over other forms of physical development, and that household growth might be thought of as driving urban growth, it is convenient to start by considering shifts in the distribution of residential delivery points. (In what follows, residential delivery points will be referred to simply as 'dwellings'). Having considered overall trends in the distribution of dwellings, attention will shift to change at the urban fringe (having regard to both residential and

non-residential development). Finally development and settlement change in the wider countryside will be examined.

3.6 To analyze the distribution of dwellings it is necessary to have some sort of tessellation on which to overlay them, and once again it is a mesh of hectare cells that is used here (coincident with that used in analyzing LUCS). Examining the variation in density across the tessellation provides an immediate appreciation of the settlement pattern (as evident in Figure 3.1). Moreover, on the basis of transforms of this grid it is possible to generate the classification of settlement types deployed in the last section (Bibby and Shepherd, 2004).

Change in the Stock of Dwellings 1998-2003

3.7 The starting point is consideration of the overall change in the distribution of residential property, by comparing -tile by tile- the number of dwellings in 1998 and at the beginning of 2004. This is large scale task, but one which is straightforward computationally. (The only serious complication lies in developing methods to compensate for improvements to grid referencing over the period which if ignored produces the illusion that property has 'moved'). This analysis immediately reveals the overall pattern of change, providing a context within which more particular aspects of development and settlement change should be understood.

3.8 The general trend involves markedly differentiated growth, with a net increase in the stock of dwellings across the rural domain of 1.18% per annum, much smaller increases (in percentage terms) across most of the urban domain, and an absolute fall in some midland and northern cities. (This last tendency arises because the much-discussed trend to intensification and reinvigoration of urban cores is more than offset by losses of households elsewhere, particularly in the inner suburbs).

3.9 The level of detail provided by the grids (illustrated in Figure 3.2), reveals a pattern of change that is more complex than discussion of 'urban encroachment' usually admits. It is worth considering some of this complexity because of the insights it provides into the processes which shape settlement change and because of the implications for understanding attempts to guide household growth through the planning system. The prime influence on the pattern of change is of course the geography of new building discussed in Section2, but this is substantially modified by treatment of existing property. Although more than 809,000 units were built in the years 1998 to 2003, the net increase in the stock of dwellings was only 616,000 units (Table 3.1). Pointedly while 62.5% of the new building took place within urban areas of 10,000 or more, these areas accommodated only 57% of the net increase in dwellings.

3.10 The pattern of settlement change implied by new housebuilding is thus offset by other types of stock adjustment that significantly shift the balance between the urban and the rural domain. The most obvious of these is demolition. Beyond this, however, non-residential property may be converted into dwellings or vice versa, large houses may be subdivided, or adjoining houses brought together. This last adjustment is particularly likely to be overlooked as it does not require planning permission. These adjustments allow for a flexibility in the number and nature of units brought to the market which is obscured by a focus on new construction. On balance, the net impact

of all these adjustments was negative, lowering the stock of dwellings (though increasing average size).

Table 3.1 New Construction and Net Change in Dwellings, 1998-2003

Context	1998 Stock	Built 98-03	Built/ Stock 98 (Pct)	Net Change 98-03	Net Change/ Stock (Pct)	Adjust ment	Adjustment/ Stock	Share of Build (Pct)	Share of Net Change (Pct)
Urban	16295970	506000	3.11	350862	2.15	-155138	-0.95	62.50	56.98
Town	1573141	92972	5.91	73484	4.67	-19488	-1.24	11.48	11.93
Fringe	763736	60138	7.87	52465	6.87	-7673	-1.00	7.43	8.52
Village	978929	45899	4.69	46760	4.78	861	0.09	5.67	7.59
Peri-Urban	358283	56423	15.75	41900	11.69	-14523	-4.05	6.97	6.80
Village Envelope	406348	26410	6.50	24034	5.91	-2376	-0.58	3.26	3.90
Hamlet	54222	1208	2.23	4818	8.89	3610	6.66	0.15	0.78
Isolated Farm	151491	1310	0.86	8452	5.58	7142	4.71	0.16	1.37
Other	199913	19202	9.61	12984	6.49	-6218	-3.11	2.37	2.11
Total	**20782033**	**809561**	**3.90**	**615759**	**2.96**	**-193802**	**-0.93**	**100.00**	**100.00**
Rural	**4486063**	**303561**	**6.77**	**264897**	**5.90**	**-38664**	**-0.86**	**37.50**	**43.02**

3.11 Taking new construction and the range of other adjustments together, the rural domain has thus played a somewhat disproportionate role in accommodating additional households, and one that is very important in absolute terms. Overall in the years 1998-2003, PAF indicates that the number of dwellings in England increased by 3%; the stock in the urban domain increasing by 2.2%, while the stock in the rural domain increased by 5.9%. It should be appreciated that this does not deny the success of policy seeking to concentrate new building in urban areas; neither has it entailed historically high levels of development at the urban fringe. Nevertheless, there appear to be important distinctions between JCAs and between types of settlement.

3.12 In some JCAs, intensification in property utilization over the period implied that the increase in the stock of dwellings was clearly greater than the number of units built (see Table 3.2a and 3.2b). The column headed ‘adjustment’ in each table shows the difference between the number of units built (recorded on LUCS) and net change. Thus it appears that in the South Hampshire Lowlands JCA in addition to construction of around 6,500 dwellings, a further 1,700 (net) were added through conversion (see Table 3.2a). Similarly in the Vale of York JCA, it appears that new building augmented the dwelling stock by 6,200 units and that this was supplemented by more than 2,300 units (net) arising out of conversion. Moreover, examination of Table 3.2b shows that in some JCAs, such as the Vale of York and the Vale of Pickering, intensification through conversion is a feature of the broader countryside.

Figure 3.1: Dwellings from PAF, 2003 (units per hectare) (grid = **Rpaf2003**)

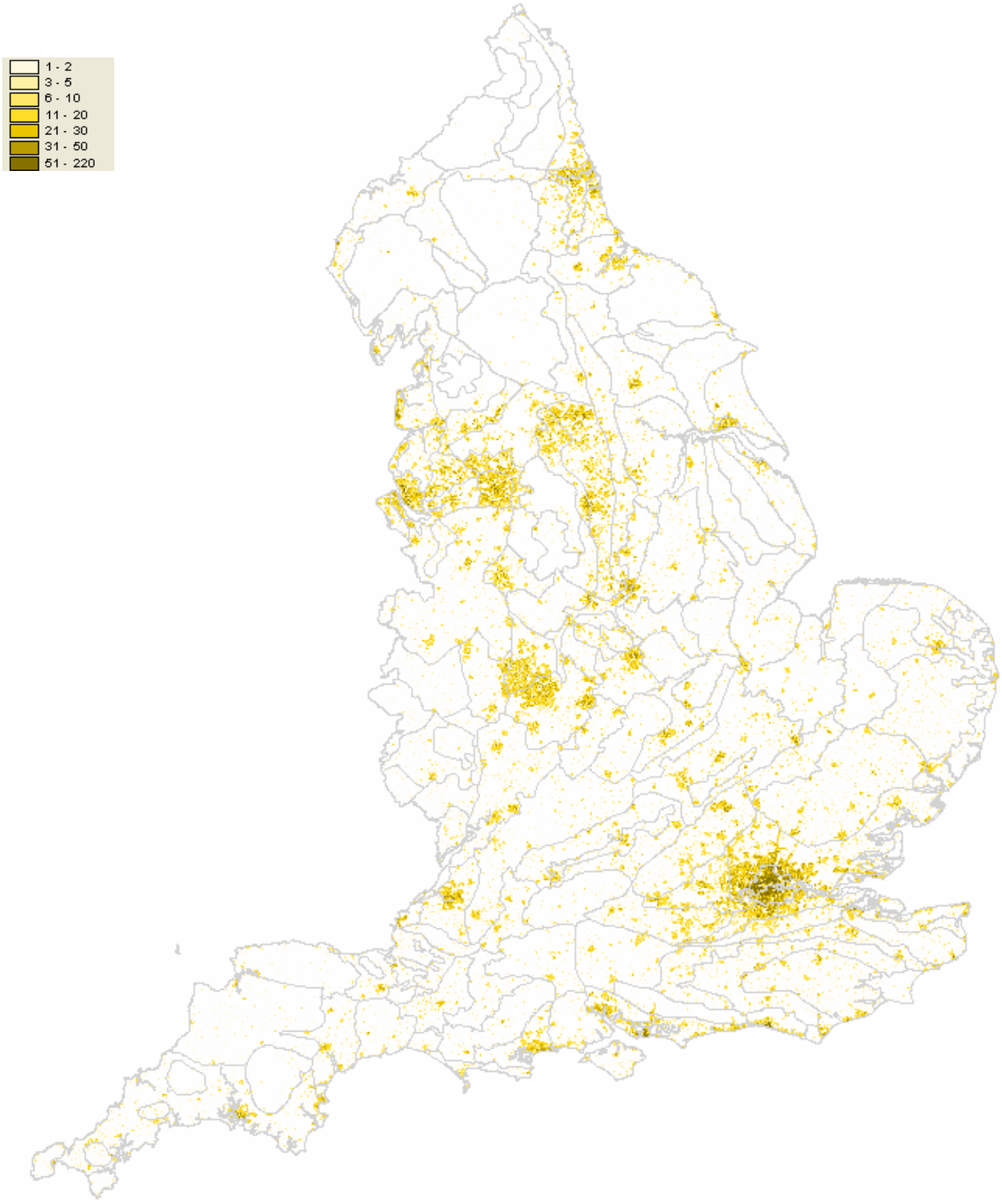
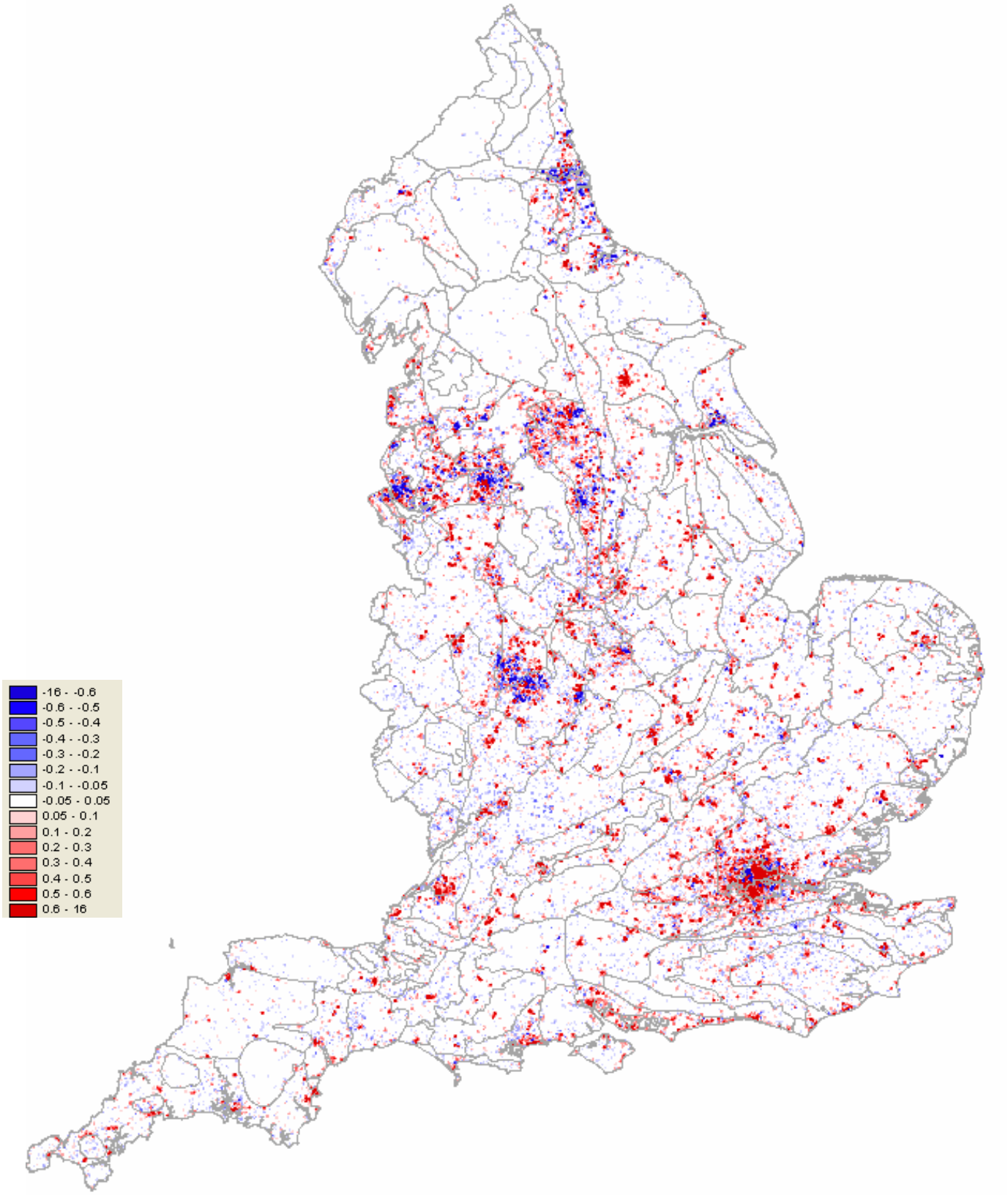


Figure 3.1 shows in increasing intensity of colour the number of dwellings in each hectare cell in 2003 (the end of the study period).

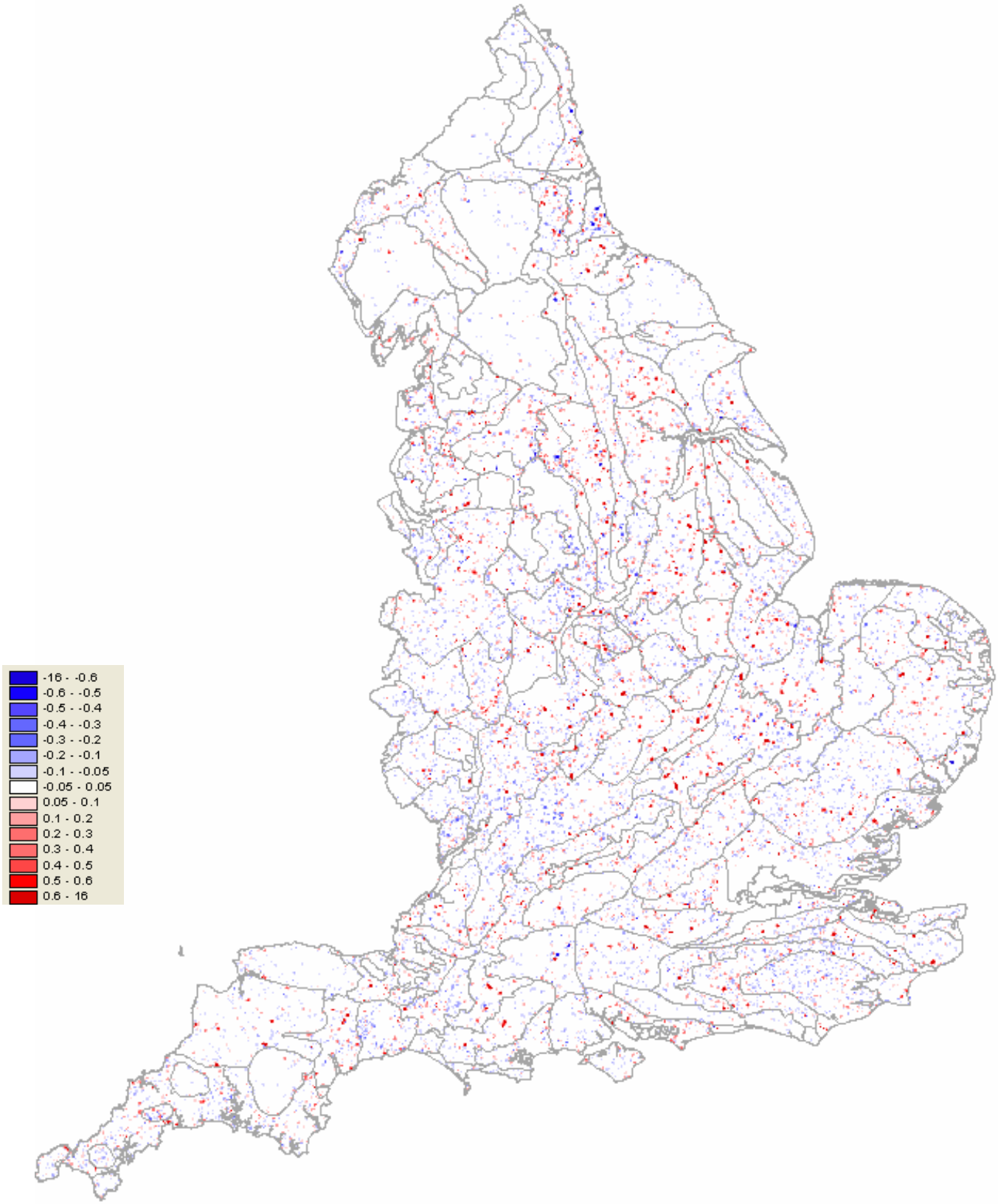
Figure 3.2a: Change in Dwelling Stock, 1998-2003 (units per hectare) (grid = **Rpafnetch800**)



a) For England

Figure 3.2 a shows the net change in dwellings in each hectare tile in the years 1998 to 2003. Increasing intensities of red indicate increasing numbers of dwellings (whether due to new building, residential subdivision or conversion from other uses). Increasing intensities of blue show falls in numbers of dwellings which may result from amalgamation to form larger units, demolitions or changes of use. Values shown are averaged over an 800m radius.

Figure 3.2b: Change in Dwelling Stock, 1998-2003 (units per hectare) (grid = **Rpafnetch800**)



b) English rural domain only

Figure 3.2b shows the net change in dwellings in each hectare tile in the years 1998 to 2003 (excluding urban areas with a population of 10,000 or more). Increasing intensities of red indicate increasing numbers of dwellings (whether due to new building, residential subdivision or conversion from other uses). Increasing intensities of blue show falls in numbers of dwellings which may result from amalgamation to form larger units, demolitions or changes of use. Values shown are averaged over an 800m radius.

Table 3.2a: New Construction and Net Change in Dwellings 1998-2003 by JCA

JCA	Stock 1998	Built 98-03	Built/ Stock (Pct)	Net Change 98-03	Net Change/ Stock (Pct)	Adjust ment	Adjustment/ Stock (Pct)	Share of Build (Pct)	Share of Net Change (Pct)
Arden	769246	25212	3.28	7344	0.95	-17868	-2.32	3.12	1.20
Avon Vale	79190	6069	7.66	6526	8.24	457	0.58	0.75	1.06
Bedfordshire and Cambridgeshire Claylands	375302	24467	6.52	17202	4.58	-7265	-1.94	3.03	2.80
Bedfordshire Greensand Ridge	34262	1959	5.72	1633	4.77	-326	-0.95	0.24	0.27
Berkshire and Marlborough Downs	32295	1540	4.77	1918	5.94	378	1.17	0.19	0.31
Black Mountains and Golden Valley	1972	131	6.64	114	5.78	-17	-0.86	0.02	0.02
Blackdowns	39922	1891	4.74	1932	4.84	41	0.10	0.23	0.31
Blackmoor Vale and The Vale of Wardour	27083	2220	8.20	2061	7.61	-159	-0.59	0.27	0.34
Bodmin Moor	3183	244	7.67	273	8.58	29	0.91	0.03	0.04
Border Moors and Forests	1778	94	5.29	137	7.71	43	2.42	0.01	0.02
Bowland Fells	523	26	4.97	70	13.38	44	8.41	0.00	0.01
Bowland Fringe and Pendle Hill	20951	1079	5.15	760	3.63	-319	-1.52	0.13	0.12
Breckland	36594	1787	4.88	1158	3.16	-629	-1.72	0.22	0.19
Bristol, Avon Valleys and Ridges	314118	11913	3.79	12698	4.04	785	0.25	1.47	2.07
Cannock Chase and Cank Wood	483767	15624	3.23	4293	0.89	-11331	-2.34	1.93	0.70
Carnmenellis	8982	314	3.50	361	4.02	47	0.52	0.04	0.06
Central Lincolnshire Vale	20047	1739	8.68	1551	7.74	-188	-0.94	0.22	0.25
Central North Norfolk	87958	4170	4.74	4338	4.93	168	0.19	0.52	0.71
Charnwood	39924	1890	4.73	1165	2.92	-725	-1.82	0.23	0.19
Cheshire Sandstone Ridge	10152	488	4.81	498	4.91	10	0.10	0.06	0.08
Cheviot Fringe	3921	199	5.08	73	1.86	-126	-3.21	0.02	0.01
Cheviots	166	1	0.60	15	9.04	14	8.43	0.00	0.00
Chilterns	366240	10629	2.90	10435	2.85	-194	-0.05	1.32	1.70
Clun and North West Herefordshire Hills	6451	369	5.72	-36	-0.56	-405	-6.27	0.05	-0.01
Cornish Killas	167190	10292	6.16	10063	6.02	-229	-0.14	1.27	1.64
Cotswolds	163635	5224	3.19	4851	2.96	-373	-0.23	0.65	0.79
Cumbria High Fells	12824	529	4.13	1020	7.95	491	3.83	0.07	0.17
Dark Peak	30478	1306	4.29	1223	4.01	-83	-0.27	0.16	0.20
Dartmoor	8595	298	3.47	298	3.47	0	0.00	0.04	0.05
Derbyshire Peak Fringe and Lower Derwent	39012	1209	3.10	835	2.14	-374	-0.96	0.15	0.14
Devon Redlands	125885	6202	4.93	5752	4.57	-450	-0.36	0.77	0.94
Dorset Downs and Cranborne Chase	30426	2205	7.25	2156	7.09	-49	-0.16	0.27	0.35
Dorset Heaths	192675	8982	4.66	5112	2.65	-3870	-2.01	1.11	0.83
Dunsmore and Feldon	70944	5088	7.17	3847	5.42	-1241	-1.75	0.63	0.63
Durham Coalfield Pennine Fringe	86524	3713	4.29	2248	2.60	-1465	-1.69	0.46	0.37
Durham Magnesian Limestone Plateau	192185	5802	3.02	124	0.06	-5678	-2.95	0.72	0.02
East Anglian Chalk	79985	2988	3.74	1823	2.28	-1165	-1.46	0.37	0.30
Eden Valley	19085	1569	8.22	2021	10.59	452	2.37	0.19	0.33
Exmoor	34041	1236	3.63	1288	3.78	52	0.15	0.15	0.21
Forest Of Dean and Lower Wye	26210	906	3.46	427	1.63	-479	-1.83	0.11	0.07
Greater Thames Estuary	257278	17393	6.76	20366	7.92	2973	1.16	2.15	3.32
Hampshire Downs	111067	5347	4.81	6197	5.58	850	0.77	0.66	1.01
Hensbarrow	5772	463	8.02	207	3.59	-256	-4.44	0.06	0.03
Herefordshire Lowlands	49014	2698	5.50	2429	4.96	-269	-0.55	0.33	0.40
Herefordshire Plateau	6141	233	3.79	327	5.32	94	1.53	0.03	0.05
High Leicestershire	19348	1404	7.26	1005	5.19	-399	-2.06	0.17	0.16
High Weald	214650	6201	2.89	5965	2.78	-236	-0.11	0.77	0.97
Holderness	92480	3287	3.55	3757	4.06	470	0.51	0.41	0.61
Howardian Hills	4703	92	1.96	74	1.57	-18	-0.38	0.01	0.01
Howgill Fells	1070	92	8.60	44	4.11	-48	-4.49	0.01	0.01

Humber Estuary	116122	1734	1.49	-1067	-0.92	-2801	-2.41	0.21	-0.17
Humberhead Levels	144184	5463	3.79	5164	3.58	-299	-0.21	0.68	0.84
Inner London	1164531	31246	2.68	37655	3.23	6409	0.55	3.87	6.13
Isle Of Porland	5208	221	4.24	249	4.78	28	0.54	0.03	0.04
Isle Of Wight	59969	2773	4.62	2600	4.34	-173	-0.29	0.34	0.42
Kesteven Uplands	26910	2054	7.63	1618	6.01	-436	-1.62	0.25	0.26
Lancashire and Amounderness Plain	281645	11328	4.02	5015	1.78	-6313	-2.24	1.40	0.82
Lancashire Coal Measures	260121	10625	4.08	4142	1.59	-6483	-2.49	1.32	0.67
Lancashire Valleys	202203	8481	4.19	1892	0.94	-6589	-3.26	1.05	0.31
Leicestershire and Nottinghamshire Wolds	36007	1529	4.25	1501	4.17	-28	-0.08	0.19	0.24
Leicestershire and South Derbyshire Coalfield	38516	3520	9.14	3400	8.83	-120	-0.31	0.44	0.55
Leicestershire Vales	227604	8590	3.77	6834	3.00	-1756	-0.77	1.06	1.11
Lincolnshire Coast and Marshes	102945	4364	4.24	3232	3.14	-1132	-1.10	0.54	0.53
Lincolnshire Wolds	12480	853	6.83	820	6.57	-33	-0.26	0.11	0.13
Low Weald	180877	9145	5.06	7347	4.06	-1798	-0.99	1.13	1.20
Lundy	13	0	0.00	0	0.00	0	0.00	0.00	0.00
Malvern Hills	5345	175	3.27	92	1.72	-83	-1.55	0.02	0.01
Manchester Conurbation	510309	18379	3.60	4753	0.93	-13626	-2.67	2.27	0.77
Manchester Pennine Fringe	378863	10460	2.76	2522	0.67	-7938	-2.10	1.29	0.41
Marshwood and Powerstock Vales	10331	698	6.75	640	6.19	-58	-0.56	0.09	0.10
Mease/Sence Lowlands	29346	1055	3.59	1161	3.96	106	0.36	0.13	0.19
Melbourne Parklands	16654	484	2.91	479	2.88	-5	-0.03	0.06	0.08
Mendip Hills	16005	955	5.97	672	4.20	-283	-1.77	0.12	0.11
Mersey Valley	188313	6776	3.60	4516	2.40	-2260	-1.20	0.84	0.74
Merseyside Conurbation	403707	14080	3.49	-438	-0.11	-14518	-3.60	1.74	-0.07
Mid Norfolk	65922	3168	4.81	2788	4.23	-380	-0.58	0.39	0.45
Mid Northumberland	10702	444	4.15	496	4.63	52	0.49	0.05	0.08
Mid Severn Sandstone Plateau	217965	6282	2.88	3445	1.58	-2837	-1.30	0.78	0.56
Mid Somerset Hills	22621	1171	5.18	1126	4.98	-45	-0.20	0.14	0.18
Midvale Ridge	95423	4058	4.25	4359	4.57	301	0.32	0.50	0.71
Morecambe Bay Limestones	23326	906	3.88	1138	4.88	232	0.99	0.11	0.19
Morecambe Coast and Lune Estuary	50079	2233	4.46	1790	3.57	-443	-0.88	0.28	0.29
Needwood and South Derbyshire Claylands	83729	3789	4.53	2872	3.43	-917	-1.10	0.47	0.47
New Forest	77975	2826	3.62	2118	2.72	-708	-0.91	0.35	0.35
North Downs	231295	7131	3.08	6687	2.89	-444	-0.19	0.88	1.09
North East Norfolk and Flegg	36620	996	2.72	233	0.64	-763	-2.08	0.12	0.04
North Kent Plain	439989	12782	2.91	9771	2.22	-3011	-0.68	1.58	1.59
North Norfolk Coast	2076	38	1.83	-17	-0.82	-55	-2.65	0.00	0.00
North Northumberland Coastal Plain	12888	536	4.16	518	4.02	-18	-0.14	0.07	0.08
North Pennines	8204	207	2.52	286	3.49	79	0.96	0.03	0.05
North West Norfolk	22956	1140	4.97	1048	4.57	-92	-0.40	0.14	0.17
North Yorkshire Moors and Cleveland Hills	61900	1628	2.63	1523	2.46	-105	-0.17	0.20	0.25
Northamptonshire Uplands	56780	3832	6.75	3463	6.10	-369	-0.65	0.47	0.56
Northamptonshire Vales	157778	11735	7.44	10106	6.41	-1629	-1.03	1.45	1.65
Northern Lincolnshire Edge With Coversands	65308	3069	4.70	2576	3.94	-493	-0.75	0.38	0.42
Northern Thames Basin	1530591	44670	2.92	33576	2.19	-11094	-0.72	5.53	5.47
Northumberland Sandstone Hills	5677	292	5.14	392	6.91	100	1.77	0.04	0.06
Nottinghamshire, Derbyshire and Yorkshire Coalfield	957698	33691	3.52	13381	1.40	-20310	-2.12	4.17	2.18
Orton Fells	2062	119	5.77	319	15.47	200	9.70	0.01	0.05
Oswestry Uplands	8192	356	4.35	453	5.53	97	1.18	0.04	0.07
Pennine Dales Fringe	56193	2332	4.15	2111	3.76	-221	-0.39	0.29	0.34
Pevensey Levels	41358	3765	9.10	3768	9.11	3	0.01	0.47	0.61
Potteries and Churnet Valley	191714	4962	2.59	4158	2.17	-804	-0.42	0.61	0.68
Quantock Hills	598	21	3.51	31	5.18	10	1.67	0.00	0.01
Rockingham Forest	59371	2866	4.83	2226	3.75	-640	-1.08	0.35	0.36
Romney Marshes	15020	671	4.47	496	3.30	-175	-1.16	0.08	0.08

Salisbury Plain and West Wiltshire Downs	53235	2369	4.45	844	1.59	-1525	-2.86	0.29	0.14
Sefton Coast	51384	909	1.77	-420	-0.82	-1329	-2.59	0.11	-0.07
Severn and Avon Vales	271816	12944	4.76	12667	4.66	-277	-0.10	1.60	2.06
Sherwood	178542	5052	2.83	4246	2.38	-806	-0.45	0.63	0.69
Shropshire Hills	18783	1031	5.49	1256	6.69	225	1.20	0.13	0.20
Shropshire, Cheshire and Staffordshire Plain	366131	17984	4.91	17321	4.73	-663	-0.18	2.23	2.82
Solway Basin	51045	2726	5.34	1938	3.80	-788	-1.54	0.34	0.32
Somerset Levels and Moors	78187	5780	7.39	5168	6.61	-612	-0.78	0.72	0.84
South Coast Plain	347942	9990	2.87	10502	3.02	512	0.15	1.24	1.71
South Cumbria Low Fells	22926	864	3.77	1405	6.13	541	2.36	0.11	0.23
South Devon	221702	6771	3.05	7716	3.48	945	0.43	0.84	1.26
South Downs	178133	3955	2.22	4703	2.64	748	0.42	0.49	0.77
South East Northumberland Coastal Plain	123744	4804	3.88	2333	1.89	-2471	-2.00	0.59	0.38
South Hampshire Lowlands	192912	6484	3.36	8217	4.26	1733	0.90	0.80	1.34
South Herefordshire and Over Severn	14209	553	3.89	459	3.23	-94	-0.66	0.07	0.07
South Norfolk and High Suffolk Claylands	76598	4330	5.65	5510	7.19	1180	1.54	0.54	0.90
South Purbeck	7401	272	3.68	124	1.68	-148	-2.00	0.03	0.02
South Suffolk and North Essex Clayland	339008	17473	5.15	17959	5.30	486	0.14	2.16	2.93
South West Peak	16434	507	3.09	670	4.08	163	0.99	0.06	0.11
Southern Lincolnshire Edge	28793	3654	12.69	4083	14.18	429	1.49	0.45	0.67
Southern Magnesian Limestone	230714	10277	4.45	7113	3.08	-3164	-1.37	1.27	1.16
Southern Pennines	173279	6841	3.95	4489	2.59	-2352	-1.36	0.85	0.73
Suffolk Coast and Heaths	119723	5103	4.26	4606	3.85	-497	-0.41	0.63	0.75
Tees Lowlands	251107	9863	3.93	4680	1.86	-5183	-2.06	1.22	0.76
Teme Valley	3560	320	8.99	299	8.40	-21	-0.59	0.04	0.05
Thames Basin Heaths	285432	12957	4.54	11259	3.94	-1698	-0.59	1.60	1.83
Thames Basin Lowlands	362636	8057	2.22	7145	1.97	-912	-0.25	1.00	1.16
Thames Valley	540397	17945	3.32	16535	3.06	-1410	-0.26	2.22	2.69
The Broads	40402	1560	3.86	1733	4.29	173	0.43	0.19	0.28
The Culm	58294	4318	7.41	4319	7.41	1	0.00	0.53	0.70
The Fens	172972	13739	7.94	10965	6.34	-2774	-1.60	1.70	1.79
The Lizard	3550	69	1.94	92	2.59	23	0.65	0.01	0.01
Trent and Belvoir Vales	183207	9840	5.37	9489	5.18	-351	-0.19	1.22	1.55
Trent Valley Washlands	130691	5695	4.36	5134	3.93	-561	-0.43	0.70	0.84
Tyne and Wear Lowlands	391234	9392	2.40	-2233	-0.57	-11625	-2.97	1.16	-0.36
Tyne Gap and Hadrian's Wall	18665	788	4.22	896	4.80	108	0.58	0.10	0.15
Upper Thames Clay Vales	214441	10933	5.10	10673	4.98	-260	-0.12	1.35	1.74
Vale Of Mowbray	20673	850	4.11	952	4.61	102	0.49	0.11	0.16
Vale Of Pickering	19983	647	3.24	1105	5.53	458	2.29	0.08	0.18
Vale Of Taunton and Quantock Fringes	53934	4124	7.65	3663	6.79	-461	-0.85	0.51	0.60
Vale Of York	91544	6179	6.75	8544	9.33	2365	2.58	0.76	1.39
Wealden Greensand	242011	9984	4.13	7572	3.13	-2412	-1.00	1.24	1.23
West Cumbria Coastal Plain	85150	2415	2.84	1358	1.59	-1057	-1.24	0.30	0.22
West Penwith	11870	369	3.11	914	7.70	545	4.59	0.05	0.15
Weymouth Lowlands	26799	1404	5.24	594	2.22	-810	-3.02	0.17	0.10
White Peak	19917	591	2.97	563	2.83	-28	-0.14	0.07	0.09
Wirral	59668	1761	2.95	1139	1.91	-622	-1.04	0.22	0.19
Yardley-Whittlewood Ridge	11313	1117	9.87	1009	8.92	-108	-0.95	0.14	0.16
Yeovil Scarplands	52522	3096	5.90	2373	4.52	-723	-1.38	0.38	0.39
Yorkshire Dales	19570	695	3.55	837	4.28	142	0.73	0.09	0.14
Yorkshire Southern Pennine Fringe	384259	11618	3.02	5566	1.45	-6052	-1.57	1.44	0.91
Yorkshire Wolds	20791	1422	6.84	1685	8.10	263	1.26	0.18	0.27
Total	**20774695**	**807938**	**3.89**	**613783**	**2.95**	**-194155**	**-0.93**	**100.00**	**100.00**

Table 3.2b: New Construction and Net Change in Dwellings 1998-2003 by JCA (excluding urban and fringe cells, 2003)

JCA	Stock 1998	Built 98-03	Built/ Stock (Pct)	Net Change 98-03	Net Change/ Stock (Pct)	Adjust ment	Adjustment/ Stock (Pct)	Share of Build (Pct)	Share of Net Change (Pct)
Arden	37109	1848	4.98	1342	3.62	-506	-1.36	1.21	1.02
Avon Vale	20419	984	4.82	1084	5.31	100	0.49	0.65	0.82
Bedfordshire and Cambridgeshire Claylands	64675	6763	10.46	4697	7.26	-2066	-3.19	4.43	3.57
Bedfordshire Greensand Ridge	8197	488	5.95	333	4.06	-155	-1.89	0.32	0.25
Berkshire and Marlborough Downs	18018	770	4.28	735	4.08	-35	-0.20	0.50	0.56
Black Mountains and Golden Valley	1972	131	6.64	114	5.78	-17	-0.86	0.09	0.09
Blackdowns	14171	587	4.14	739	5.21	152	1.07	0.38	0.56
Blackmoor Vale and The Vale Of Wardour	14563	841	5.78	821	5.64	-20	-0.14	0.55	0.62
Bodmin Moor	2812	244	8.68	296	10.53	52	1.85	0.16	0.22
Border Moors and Forests	1778	94	5.29	137	7.71	43	2.42	0.06	0.10
Bowland Fells	523	26	4.97	70	13.38	44	8.41	0.02	0.05
Bowland Fringe and Pendle Hill	10263	505	4.92	395	3.85	-110	-1.07	0.33	0.30
Breckland	12896	644	5.00	358	2.78	-286	-2.22	0.42	0.27
Bristol, Avon Valleys and Ridges	25477	1103	4.33	1462	5.74	359	1.41	0.72	1.11
Cannock Chase and Cank Wood	12667	844	6.66	615	4.86	-229	-1.81	0.55	0.47
Carnmenellis	5597	199	3.56	241	4.31	42	0.75	0.13	0.18
Central Lincolnshire Vale	11939	1181	9.89	999	8.37	-182	-1.53	0.77	0.76
Central North Norfolk	20777	1285	6.18	1103	5.31	-182	-0.87	0.84	0.84
Charnwood	5242	443	8.45	222	4.24	-221	-4.21	0.29	0.17
Cheshire Sandstone Ridge	6536	332	5.08	372	5.69	40	0.61	0.22	0.28
Cheviot Fringe	3282	194	5.91	61	1.86	-133	-4.05	0.13	0.05
Cheviots	166	1	0.60	15	9.04	14	8.43	0.00	0.01
Chilterns	56055	1939	3.46	2110	3.76	171	0.31	1.27	1.60
Clun and North West Herefordshire Hills	4965	342	6.88	-49	-0.99	-391	-7.87	0.22	-0.04
Cornish Killas	64439	3729	5.79	3573	5.54	-156	-0.24	2.44	2.72
Cotswolds	61542	2218	3.60	2113	3.43	-105	-0.17	1.45	1.61
Cumbria High Fells	8838	448	5.07	869	9.83	421	4.76	0.29	0.66
Dark Peak	9576	303	3.17	228	2.38	-75	-0.78	0.20	0.17
Dartmoor	6536	198	3.03	220	3.37	22	0.34	0.13	0.17
Derbyshire Peak Fringe and Lower Derwent	15867	519	3.27	270	1.70	-249	-1.57	0.34	0.21
Devon Redlands	23714	1757	7.41	1655	6.98	-102	-0.43	1.15	1.26
Dorset Downs and Cranborne Chase	17150	988	5.76	870	5.07	-118	-0.69	0.65	0.66
Dorset Heaths	12970	676	5.21	118	0.91	-558	-4.30	0.44	0.09
Dunsmore and Feldon	13877	1287	9.27	1262	9.09	-25	-0.18	0.84	0.96
Durham Coalfield Pennine Fringe	20479	1182	5.77	882	4.31	-300	-1.47	0.77	0.67
Durham Magnesian Limestone Plateau	14643	811	5.54	343	2.34	-468	-3.20	0.53	0.26
East Anglian Chalk	24543	1206	4.91	697	2.84	-509	-2.07	0.79	0.53
Eden Valley	9732	785	8.07	1341	13.78	556	5.71	0.51	1.02
Exmoor	13726	401	2.92	615	4.48	214	1.56	0.26	0.47
Forest Of Dean and Lower Wye	13599	466	3.43	190	1.40	-276	-2.03	0.31	0.14
Greater Thames Estuary	15437	1485	9.62	543	3.52	-942	-6.10	0.97	0.41
Hampshire Downs	27415	1438	5.25	1060	3.87	-378	-1.38	0.94	0.81
Hensbarrow	3877	194	5.00	29	0.75	-165	-4.26	0.13	0.02
Herefordshire Lowlands	16575	1114	6.72	883	5.33	-231	-1.39	0.73	0.67
Herefordshire Plateau	3668	171	4.66	222	6.05	51	1.39	0.11	0.17
High Leicestershire	8196	585	7.14	192	2.34	-393	-4.80	0.38	0.15
High Weald	54610	1905	3.49	1650	3.02	-255	-0.47	1.25	1.25
Holderness	13751	967	7.03	1002	7.29	35	0.25	0.63	0.76
Howardian Hills	2224	46	2.07	38	1.71	-8	-0.36	0.03	0.03
Howgill Fells	608	47	7.77	5	0.82	-42	-6.95	0.03	0.00

Humber Estuary	2635	165	6.25	104	3.95	-61	-2.31	0.11	0.08
Humberhead Levels	34203	2401	7.02	2493	7.29	92	0.27	1.57	1.89
Inner London	651	13	2.00	27	4.15	14	2.15	0.01	0.02
Isle Of Porland	500	22	4.40	-21	-4.20	-43	-8.60	0.01	-0.02
Isle Of Wight	14051	570	4.06	455	3.24	-115	-0.82	0.37	0.35
Kesteven Uplands	11800	1243	10.54	1145	9.70	-98	-0.83	0.81	0.87
Lancashire and Amounderness Plain	27443	2004	7.30	983	3.58	-1021	-3.72	1.31	0.75
Lancashire Coal Measures	11655	826	7.09	704	6.04	-122	-1.05	0.54	0.53
Lancashire Valleys	18370	1790	9.75	1415	7.70	-375	-2.04	1.17	1.08
Leicestershire and Nottinghamshire Wolds	12025	517	4.30	457	3.80	-60	-0.50	0.34	0.35
Leicestershire and South Derbyshire Coalfield	9553	1088	11.39	922	9.65	-166	-1.74	0.71	0.70
Leicestershire Vales	12774	678	5.31	376	2.94	-302	-2.37	0.44	0.29
Lincolnshire Coast and Marshes	16547	1242	7.51	990	5.98	-252	-1.52	0.81	0.75
Lincolnshire Wolds	7438	404	5.43	274	3.68	-130	-1.75	0.26	0.21
Low Weald	51034	2711	5.31	1807	3.54	-904	-1.77	1.78	1.37
Lundy	13	0	0.00	0	0.00	0	0.00	0.00	0.00
Malvern Hills	3198	110	3.44	83	2.60	-27	-0.84	0.07	0.06
Manchester Conurbation	1496	377	25.20	105	7.02	-272	-18.18	0.25	0.08
Manchester Pennine Fringe	8524	309	3.62	232	2.72	-77	-0.90	0.20	0.18
Marshwood and Powerstock Vales	3617	344	9.50	311	8.60	-33	-0.90	0.23	0.24
Mease/Sence Lowlands	6919	382	5.51	397	5.74	15	0.22	0.25	0.30
Melbourne Parklands	3234	191	5.91	244	7.54	53	1.64	0.13	0.19
Mendip Hills	6935	363	5.23	269	3.88	-94	-1.35	0.24	0.20
Mersey Valley	11261	872	7.74	831	7.38	-41	-0.36	0.57	0.63
Merseyside Conurbation	2468	286	11.57	-132	-5.35	-418	-16.92	0.19	-0.10
Mid Norfolk	20739	1143	5.51	1200	5.79	57	0.27	0.75	0.91
Mid Northumberland	4967	254	5.11	304	6.12	50	1.01	0.17	0.23
Mid Severn Sandstone Plateau	19240	1473	7.65	1158	6.02	-315	-1.64	0.97	0.88
Mid Somerset Hills	12598	683	5.43	826	6.56	143	1.13	0.45	0.63
Midvale Ridge	13343	732	5.49	738	5.53	6	0.05	0.48	0.56
Morecambe Bay Limestones	11682	616	5.27	878	7.52	262	2.25	0.40	0.67
Morecambe Coast and Lune Estuary	2597	289	11.14	439	16.90	150	5.77	0.19	0.33
Needwood and South Derbyshire Claylands	14190	1307	9.21	1368	9.64	61	0.43	0.86	1.04
New Forest	17800	959	5.39	583	3.28	-376	-2.11	0.63	0.44
North Downs	48556	2307	4.75	1994	4.11	-313	-0.64	1.51	1.52
North East Norfolk and Flegg	8553	289	3.38	325	3.80	36	0.42	0.19	0.25
North Kent Plain	26709	2211	8.28	1130	4.23	-1081	-4.05	1.45	0.86
North Norfolk Coast	1228	21	1.71	-10	-0.81	-31	-2.52	0.01	-0.01
North Northumberland Coastal Plain	6116	406	6.65	398	6.51	-8	-0.14	0.27	0.30
North Pennines	7414	167	2.25	245	3.30	78	1.05	0.11	0.19
North West Norfolk	14484	627	4.33	579	4.00	-48	-0.33	0.41	0.44
North Yorkshire Moors and Cleveland Hills	15636	292	1.87	230	1.47	-62	-0.40	0.19	0.17
Northamptonshire Uplands	17611	1087	6.17	1024	5.81	-63	-0.36	0.71	0.78
Northamptonshire Vales	19609	2088	10.65	1476	7.53	-612	-3.12	1.37	1.12
Northern Lincolnshire Edge With Coversands	8523	908	10.66	565	6.63	-343	-4.03	0.60	0.43
Northern Thames Basin	67574	3841	5.68	1900	2.81	-1941	-2.87	2.52	1.44
Northumberland Sandstone Hills	2026	115	5.68	157	7.75	42	2.07	0.08	0.12
Nottinghamshire, Derbyshire and Yorkshire Coalfield	53101	2853	5.37	1780	3.35	-1073	-2.02	1.87	1.35
Orton Fells	2062	107	5.19	279	13.53	172	8.34	0.07	0.21
Oswestry Uplands	3191	171	5.36	176	5.52	5	0.16	0.11	0.13
Pennine Dales Fringe	15113	752	4.97	987	6.53	235	1.56	0.49	0.75
Pevensey Levels	1995	11	0.55	39	1.95	28	1.40	0.01	0.03
Potteries and Churnet Valley	15413	714	4.63	483	3.13	-231	-1.50	0.47	0.37
Quantock Hills	598	21	3.51	31	5.18	10	1.67	0.01	0.02
Rockingham Forest	9063	578	6.38	152	1.68	-426	-4.70	0.38	0.12
Romney Marshes	8873	391	4.40	276	3.11	-115	-1.29	0.26	0.21

Salisbury Plain and West Wiltshire Downs	21628	783	3.62	84	0.39	-699	-3.23	0.51	0.06
Sefton Coast	1117	16	1.43	5	0.45	-11	-0.98	0.01	0.00
Severn and Avon Vales	57284	2544	4.44	2366	4.13	-178	-0.31	1.67	1.80
Sherwood	7193	441	6.14	260	3.61	-181	-2.52	0.29	0.20
Shropshire Hills	10664	521	4.89	693	6.50	172	1.61	0.34	0.53
Shropshire, Cheshire and Staffordshire Plain	75828	4080	5.38	3760	4.96	-320	-0.42	2.67	2.86
Solway Basin	14224	835	5.87	1078	7.58	243	1.71	0.55	0.82
Somerset Levels and Moors	13282	997	7.51	893	6.72	-104	-0.78	0.65	0.68
South Coast Plain	17685	1039	5.88	1303	7.37	264	1.49	0.68	0.99
South Cumbria Low Fells	9247	323	3.49	526	5.69	203	2.20	0.21	0.40
South Devon	29412	1368	4.65	1711	5.82	343	1.17	0.90	1.30
South Downs	13882	447	3.22	260	1.87	-187	-1.35	0.29	0.20
South East Northumberland Coastal Plain	9582	412	4.30	470	4.91	58	0.60	0.27	0.36
South Hampshire Lowlands	8429	612	7.26	836	9.92	224	2.65	0.40	0.64
South Herefordshire and Over Severn	8095	351	4.34	304	3.76	-47	-0.58	0.23	0.23
South Norfolk and High Suffolk Claylands	48370	1873	3.87	2654	5.49	781	1.61	1.23	2.02
South Purbeck	2362	50	2.12	0	0.00	-50	-2.12	0.03	0.00
South Suffolk and North Essex Clayland	78454	3846	4.90	3598	4.59	-248	-0.32	2.52	2.73
South West Peak	5985	140	2.34	333	5.56	193	3.22	0.09	0.25
Southern Lincolnshire Edge	8815	957	10.86	992	11.25	35	0.39	0.63	0.75
Southern Magnesian Limestone	35170	1971	5.60	1533	4.36	-438	-1.25	1.29	1.16
Southern Pennines	33896	2155	6.36	1749	5.16	-406	-1.20	1.41	1.33
Suffolk Coast and Heaths	22338	1344	6.02	973	4.36	-371	-1.66	0.88	0.74
Tees Lowlands	15303	1812	11.84	989	6.46	-823	-5.38	1.19	0.75
Teme Valley	2930	250	8.53	219	7.47	-31	-1.06	0.16	0.17
Thames Basin Heaths	44005	2217	5.04	2164	4.92	-53	-0.12	1.45	1.64
Thames Basin Lowlands	11777	542	4.60	725	6.16	183	1.56	0.36	0.55
Thames Valley	29847	1289	4.32	1068	3.58	-221	-0.74	0.84	0.81
The Broads	16417	679	4.13	813	4.95	134	0.82	0.44	0.62
The Culm	31920	2133	6.68	2068	6.48	-65	-0.20	1.40	1.57
The Fens	64790	5740	8.86	4746	7.33	-994	-1.53	3.76	3.61
The Lizard	3195	61	1.91	83	2.60	22	0.69	0.04	0.06
Trent and Belvoir Vales	34695	3416	9.85	2826	8.15	-590	-1.70	2.24	2.15
Trent Valley Washlands	9625	654	6.79	543	5.64	-111	-1.15	0.43	0.41
Tyne and Wear Lowlands	10871	600	5.52	274	2.52	-326	-3.00	0.39	0.21
Tyne Gap and Hadrian's Wall	7020	209	2.98	348	4.96	139	1.98	0.14	0.26
Upper Thames Clay Vales	44900	2518	5.61	2493	5.55	-25	-0.05	1.65	1.89
Vale Of Mowbray	8586	379	4.41	621	7.23	242	2.82	0.25	0.47
Vale Of Pickering	6393	189	2.96	541	8.46	352	5.50	0.12	0.41
Vale Of Taunton and Quantock Fringes	13958	907	6.50	791	5.67	-116	-0.83	0.59	0.60
Vale Of York	15659	1541	9.84	2328	14.87	787	5.02	1.01	1.77
Wealden Greensand	60434	2774	4.59	1864	3.08	-910	-1.51	1.82	1.42
West Cumbria Coastal Plain	15844	657	4.15	415	2.62	-242	-1.53	0.43	0.32
West Penwith	4569	114	2.50	341	7.46	227	4.97	0.07	0.26
Weymouth Lowlands	3041	160	5.27	80	2.63	-80	-2.64	0.11	0.06
White Peak	8540	334	3.91	338	3.96	4	0.05	0.22	0.26
Wirral	5288	197	3.73	297	5.62	100	1.89	0.13	0.23
Yardley-Whittlewood Ridge	5702	288	5.04	194	3.40	-94	-1.64	0.19	0.15
Yeovil Scarplands	19501	813	4.17	607	3.11	-206	-1.06	0.53	0.46
Yorkshire Dales	10809	427	3.95	498	4.61	71	0.66	0.28	0.38
Yorkshire Southern Pennine Fringe	21063	942	4.47	1087	5.16	145	0.69	0.62	0.83
Yorkshire Wolds	10814	626	5.79	526	4.86	-100	-0.93	0.41	0.40
Total	**2657077**	**152611**	**5.74**	**131591**	**4.95**	**-21020**	**-0.79**	**100.00**	**100.00**

3.13 The role of the countryside in accommodating additional households must be understood as involving not only urban expansion but urban intrusion. The following paragraphs explore this in increasing depth, starting by considering the role of different settlement classes gradually uncovering some of the detailed adjustments which underlie these patterns and working towards some appreciation of broader associated economic and social processes.

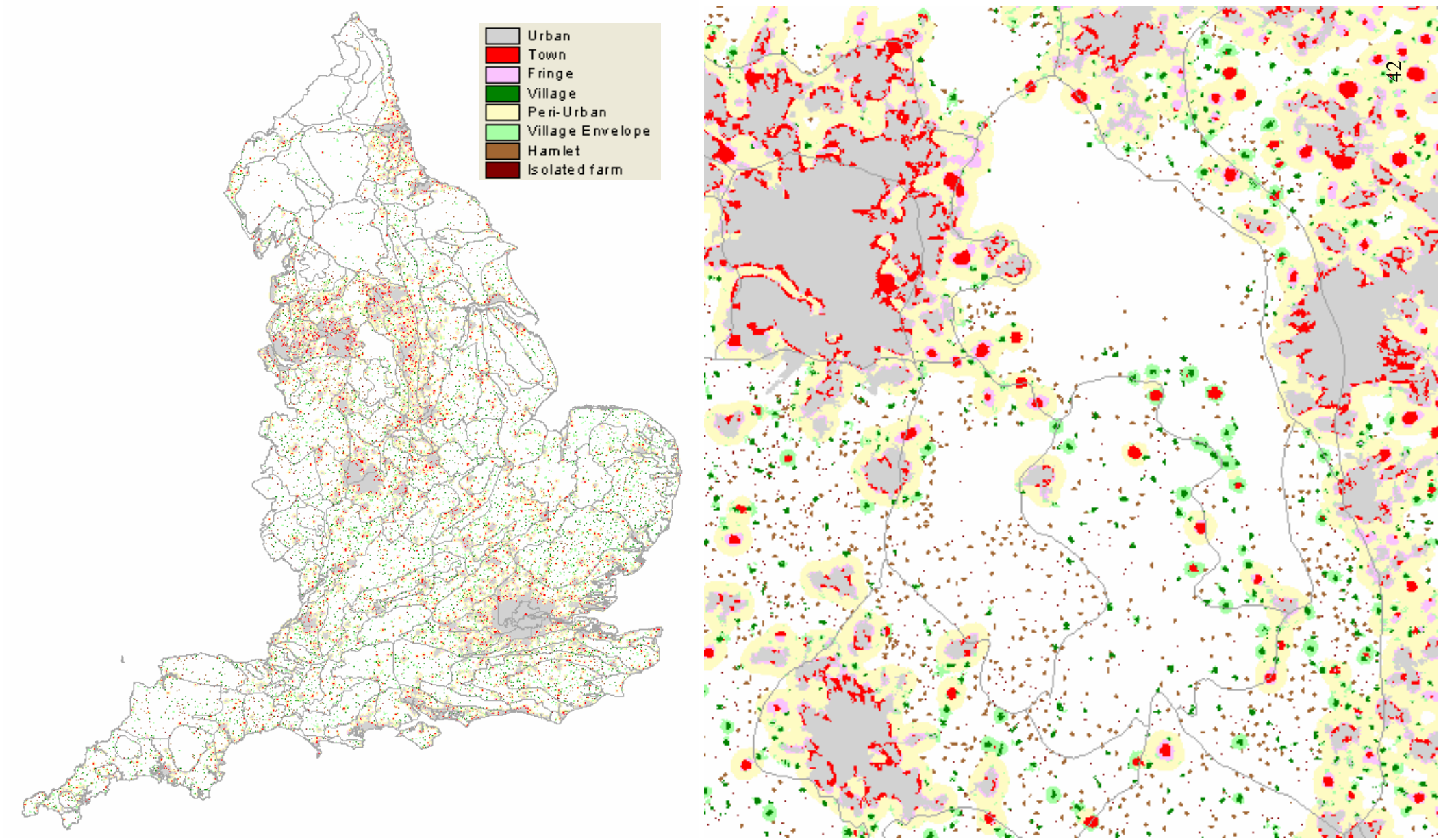
Change at the Urban Fringe; New Urban Residential Enclaves

3.14 The contribution of areas within different settlement categories to accommodating additional dwellings is summarized in Table 3.1. The morphological categories used in Table 3.1 refer to states in 2001. The 'fringe category refers to a narrow band at the very limit of the contiguous urban area, while the 'periurban' refers to a much broader area (see Figure 3.3). This suggests that over the period rather more than 116,000 new dwellings were built at or near the urban margin. These two zones together accommodated one newly built house in seven, and one sixth of the net increase in dwellings. The following paragraphs take this further by introducing a series of measures of urban expansion allowing comparisons between JCAs.

3.15 The combined change in the fringe and the periurban zone overstates the number of dwellings accommodated within the *contiguous* urban area, and does not directly indicate the increase in urban extent. For the purposes of this project, urban expansion has been gauged in two ways. The first approach involves simulating urban areas, using a method developed for the Countryside Agency's Urban and Rural Definitions project, based on the estimation of density profiles (see Bibby and Shepherd, 2004). Within that study, urban areas were identified as sets of cells where residential density measured at the 800 metre scale exceeded eight dwellings to the hectare. The same method has been used here to build two additional settlement classifications comparable with that discussed above; one for 1998 and another for 2004. An indicator of change has then be constructed by examining the areas of difference between them. This provides a good approximation to the overall extent of growth in the contiguous urban area within each JCA, but it is less satisfactory in providing a detailed urban edge. The output is the **Morph_ugrowth** grid, which is illustrated in Figure 3.4.

3.16 To supplement this, a second indicator has been developed for this project which has a closer relation to changes of the detailed form of the contiguous urban area. This attempts to chart new urban enclaves by first identifying new streets appearing on the Postcode Address File in the years 1998 to 2003 and then considering the footprint of property served by these streets.

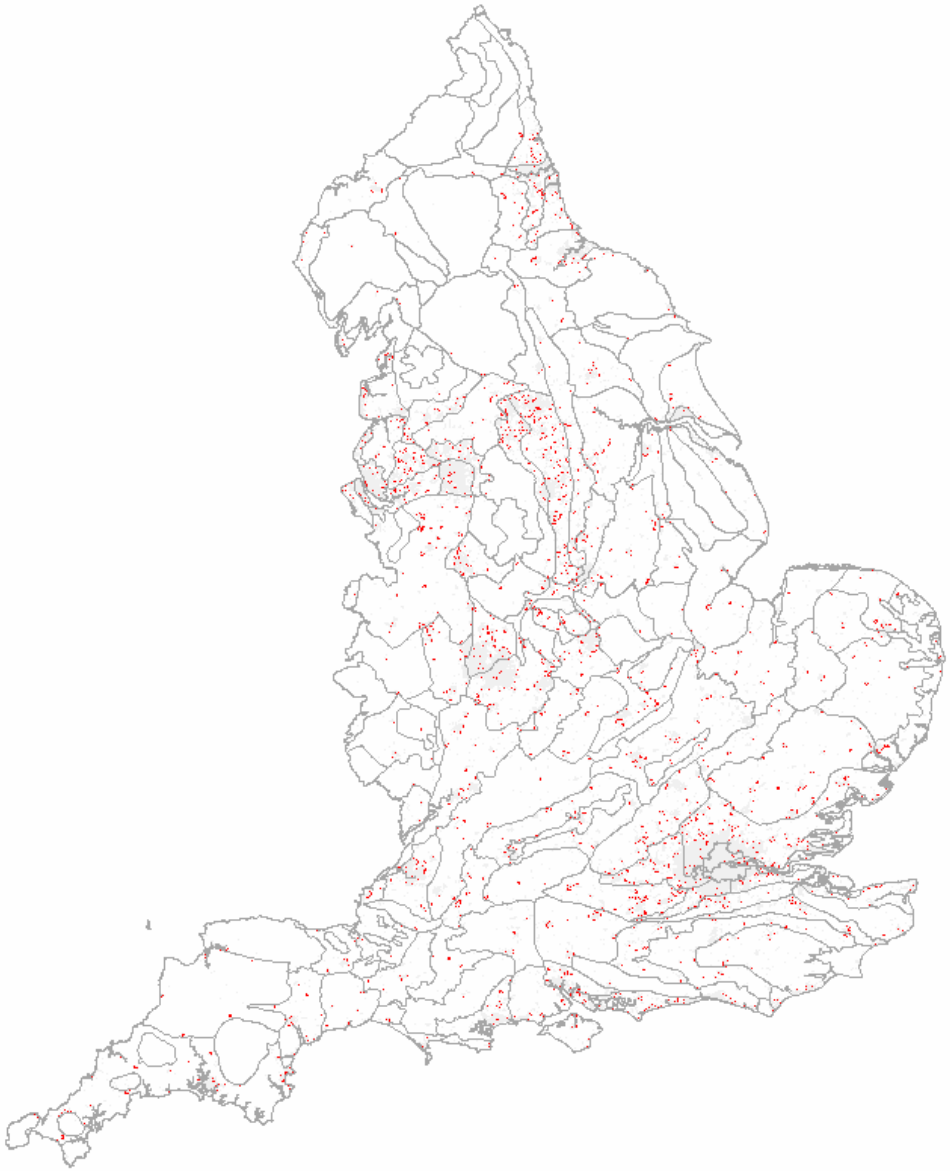
Figure 3.3: Settlement Classification, 2001 (grid = **Morphnov01**)



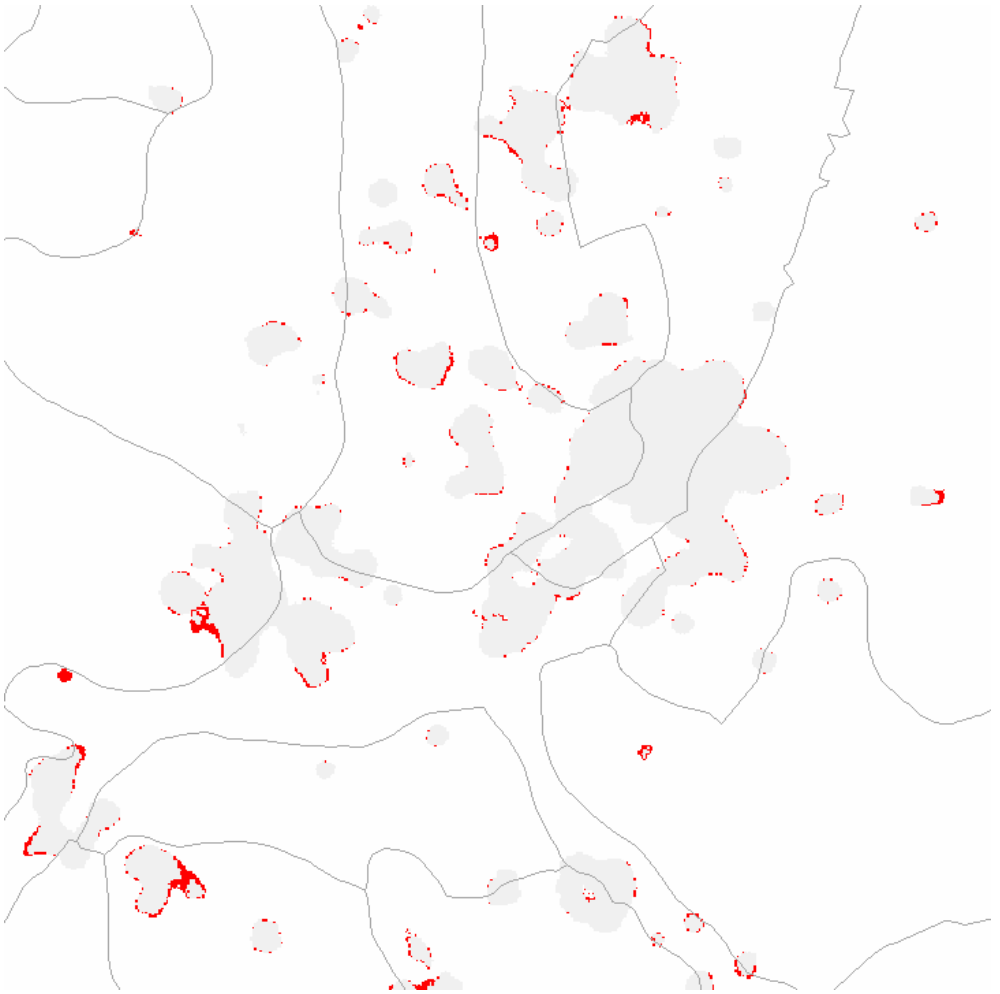
a) For England

b) Inset for the Peak District

Figure 3.4: Simulated Urban Growth (grid = **Morph_ugrowth**)



a) For England



b) Inset for Nottingham/Derby

3.17 The Post Code Address File is well suited to finding new streets, though the process is not quite as straightforward as it might seem initially. It is easy in principle to examine all the terms appearing in the 'thoroughfare' or 'dependent thoroughfare' field of PAF for a particular quarter and determine whether the same terms have appeared before (these two PAF fields are referred to in the rest of this document as the thoroughfare fields). In practice, the method must be rather more complex because it is necessary to restrict the analysis to only those thoroughfares that correspond to streets in a more limited sense (setting aside caravan sites or business parks for example to which the thoroughfare fields in PAF may also refer). It is also necessary to take account of new dwellings built on long established highways that have hitherto not served property directly, and of streets which appear new simply because of textual changes (such as changes in spelling and word division in the thoroughfare fields, or the allocation of new postcodes).

3.18 The process of differentiating streets from other features referenced by the 'thoroughfare' fields in PAF merits some comment. The manner in which PAF is structured is well suited to most property, but an important minority of development forms do not fit easily with what might be termed the 'street and plot' model. Business, parks, country houses, barracks, airfields, shopping malls and industrial estates provide a range of examples. Such features variously appear on PAF as 'thoroughfares' or 'dependent thoroughfares'; 'double dependent localities' or 'dependent localities'; or as individual addresses. NLP techniques have been used to restrict the analysis to streets forming new residential enclaves, setting aside those new textual entries that refer to development units of a different character. (These other types of new entrant are considered further in para 3.28).

3.19 Some 19,611 distinct text strings appear in the thoroughfare fields of PAF in Quarter II of 2004 that were not included in 1998, of which 17,283 (88%) would seem to represent streets in a narrow sense. For each of this reduced set of streets, the associated residential property has been found and the number of units assigned to a grid (as shown in Figure 3.5). This grid includes 298,624 properties. The footprint of the properties associated with any street approximates what is termed in Section 4 the 'street parcel'. New street parcels are not only found at the urban margin, of course, but include:

- i) new streets within the existing urban area (on previously developed sites, for example)
- ii) new streets in or on the fringe of villages,
- iii) small settlements-(such as expanded farms) being treated as streets
- iv) development on highways without previous development

3.20 These forms are not relevant to the immediate question of expansion of the contiguous urban area, though forms ii to iv are considered further under countryside development. To generate a measure of urban expansion, the grid of residential property served by new streets has been overlaid on the settlement classification grid (allowing abstraction from forms i to iv), producing the grid illustrated in Figure 3.6. Inevitably, there may be doubt as to whether this development is genuinely contiguous with the urban area. Of necessity, this can only be resolved by reference to some arbitrary rule. Thus in defining urban areas for use with data from the decennial

population census, Ordnance Survey use a distance a distance cut-off. The indicator developed here depends on a rule that has regard to:

- the density of *new* development at the 100m scale (greater than 20 units to the hectare)
- the density of *new* development at the 200m scale (greater than 5 units to the hectare),
- the density of *all* development in *2001* at the 800m (less than eight units to the hectare), and
- the density of *all* development in *2003* at the 1600m scale (greater than 3 units to the hectare)

The test on density at the 100 and 200 metre scales weeds out very scattered development, while the test on the 1600m scale ensures that there is a degree of proximity to urban areas previously defined. The test at the 800 metre scale ensures that the candidate street-parcels are outside areas which were deemed urban in 2001.

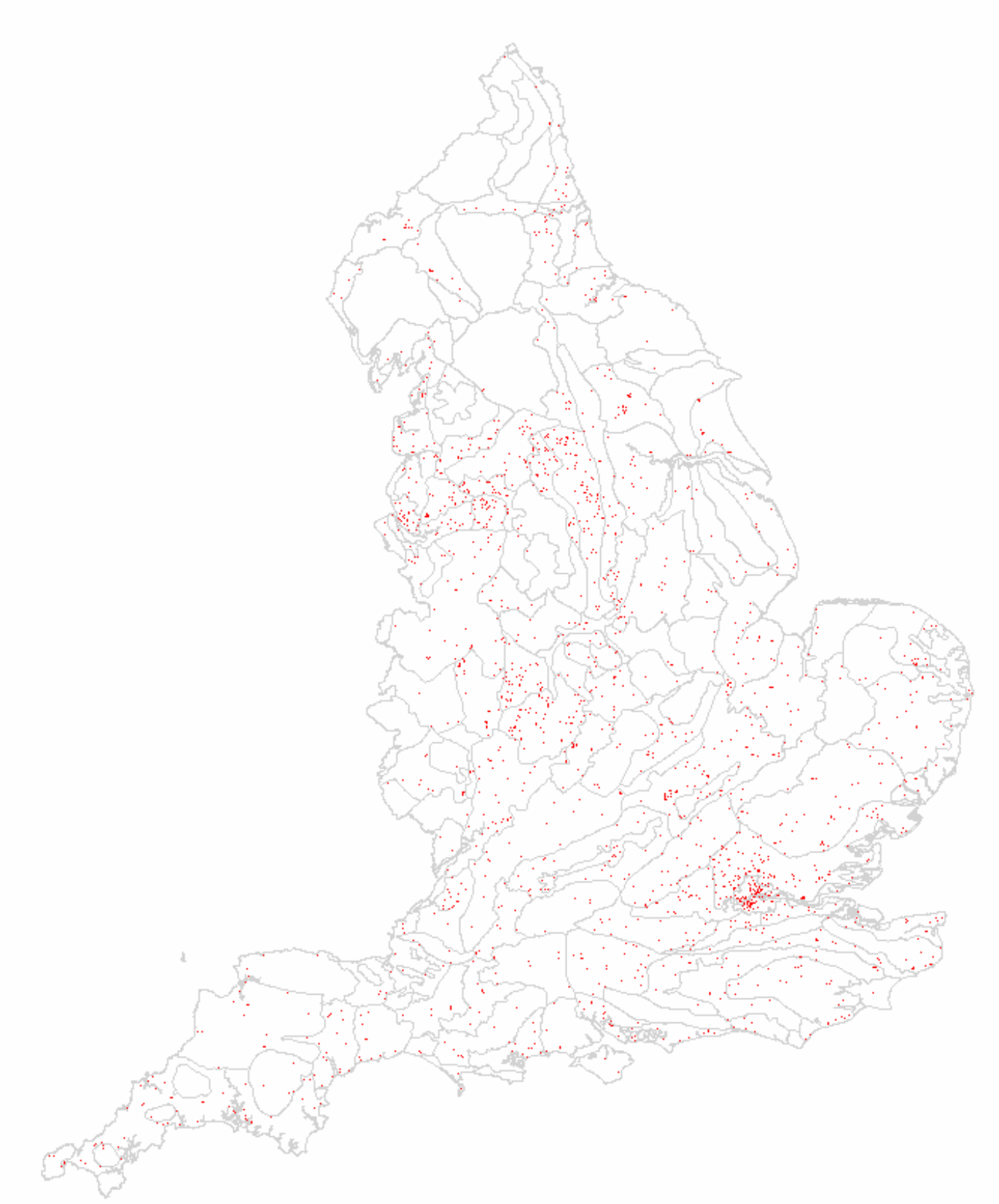
3.21 The logic of such rules extends the principles used in developing the settlement classification. It is probably easiest to appreciate their nature by illustrating how they work in practice. Figure 3.6 shows the footprint of property in part of Essex and Suffolk served by streets laid out in the years 1998 to 2003. The rules set out in para 3.15 serve to isolate new streets at the urban fringe- that is the urban expansion component of residential development. (They identify development at the east of Braintree, for example, to the North East of Chelmsford, and to the North of Colchester). They allow a distinction to be made with other street parcels (such as those within the contiguous urban area of Chelmsford and to the south and completely separate from the contiguous urban area of Braintree).

3.22 This measure of residential urban expansion is encapsulated in the **Nstreetgrowth** grid illustrated in Figure 3.7. Comparison of the two measures of residential urban expansion at JCA level are included in Table 3.3.

Change at the Urban Fringe: New Non Residential Development

3.23 While in quantitative terms development is dominated by residential uses, change to particular non-residential uses such as retail parks, distribution parks, and so on, obviously have very important implications for landscape quality and character. The most straightforward forms of analysis (as with the residential case) are those which rest simply on changes in the number of delivery points. Just as it is possible to assemble a grid indicating the number of domestic delivery points in every hectare tile, it is also possible to show the number of non-residential delivery points in those tiless. The overall distribution of non-residential units by tile (generalised to the 200 metre level) is shown in Figure 3.8. Because of the heterogenous nature of the facilities denoted by business addresses, however, only the grossest analyses of change in numbers on non-residential delivery points can be justified. Concentrating on change in non-residential delivery points per hectare runs the risk of privileging offices providing mailing address services over extensive facilities such as distribution parks. Concentrating on rate of growth of units relative to the 1998 stock risks drawing attention to change on very small bases. (Loss of village shops and pub cannot therefore be addressed in this manner).

Figure 3.5 : Location of New Streets (grid = **Newstreets**)



The Newstreets grid simply indicates the 'footprint' of new streets developed between 1998 and 2003 constructed between 1998 and 2003 regardless of their location.

Figure 3.6: Construction of New Streets (inset of part of Essex and Suffolk)

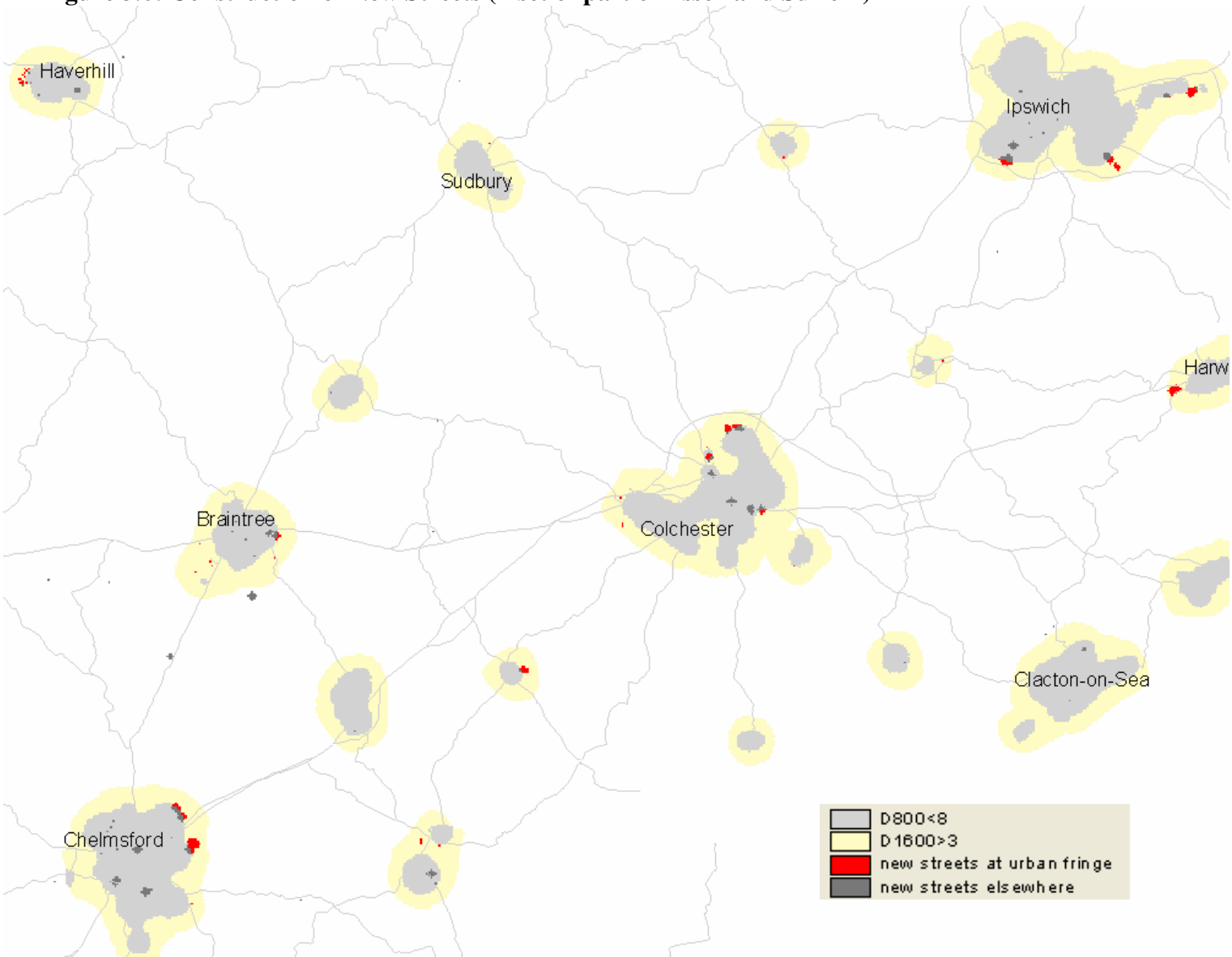
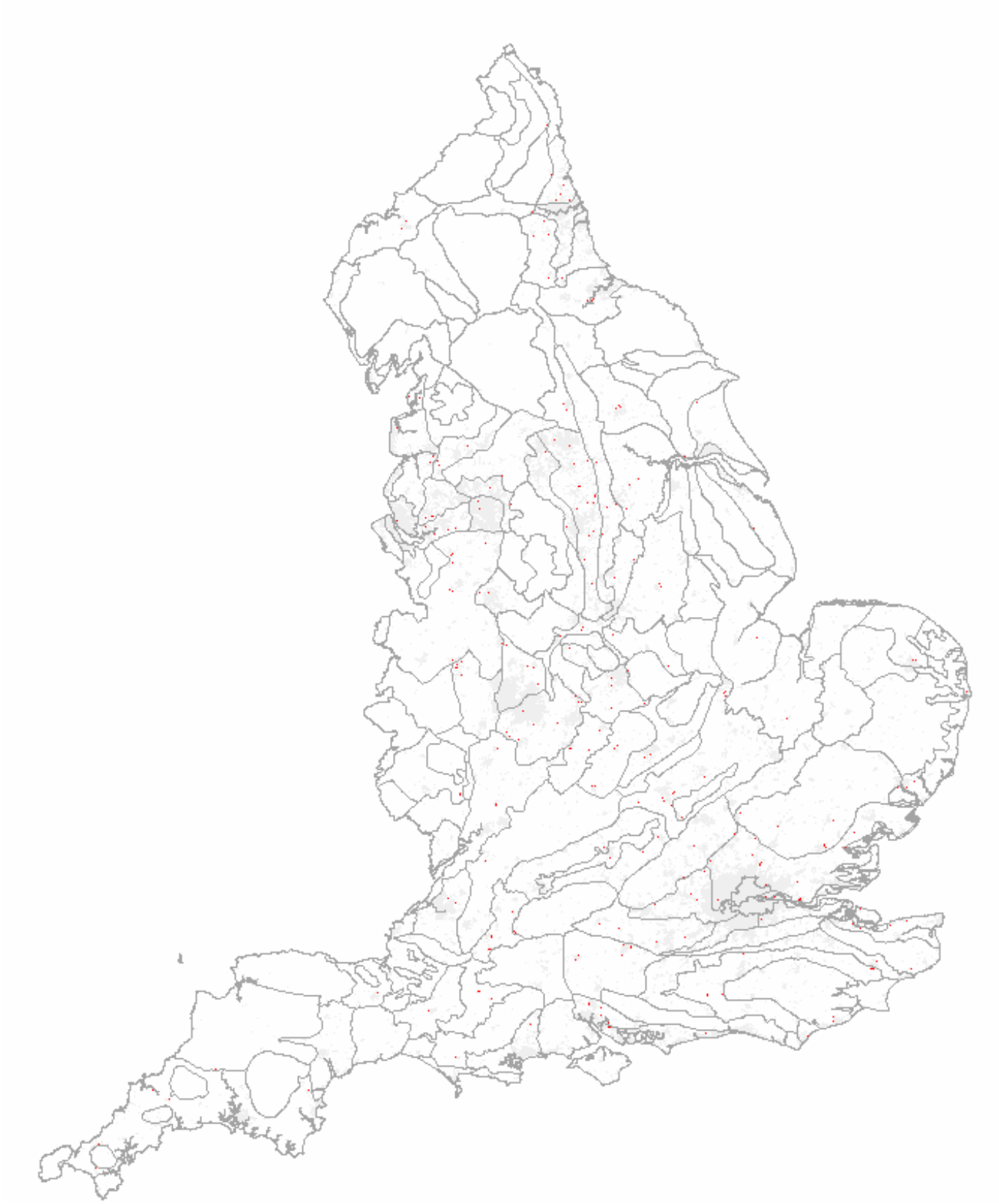


Figure 3.7: Urban Growth Shown by the Development of New Streets (grid = **Nstreetgrowth**)



The Nstreetgrowth grid indicates the 'footprint' of new streets developed between 1998 and 2003 constructed between 1998 and 2003 and which contributed to the extension of the contiguous urban area.

Table 3.3: Residential Urban Expansion at JCA level

JCA	Total JCA area (hectares)	Generalised urban area 1998 (hectares)	Level of urbanisation 1998 (Pct)	Generalised urban area growth 98-03 (hectares)	Growth in residential streets (hectares)	Urban growth (residential) (hectares)	Rate of urban growth (%pa)	Rate of change to urban area (residential) (%pa)
Arden	143429	39552	27.58	725	174	847	0.43	0.12
Avon Vale	64282	2959	4.60	332	69	361	2.44	0.11
Bedfordshire and Cambridgeshire Claylands	260549	15448	5.93	731	223	889	1.15	0.07
Bedfordshire Greensand Ridge	27350	1160	4.24	88	12	90	1.55	0.07
Berkshire and Marlborough Downs	110996	480	0.43	103	26	128	5.33	0.02
Black Mountains and Golden Valley	25967	0	0.00	0	0	0	0.00	0.00
Blackdowns	80820	1076	1.33	104	1	104	1.93	0.03
Blackmoor Vale and The Vale Of Wardour	78413	358	0.46	63	6	65	3.63	0.02
Bodmin Moor	28569	0	0.00	0	0	0	0.00	0.00
Border Moors and Forests	127149	0	0.00	0	0	0	0.00	0.00
Bowland Fells	37394	0	0.00	0	0	0	0.00	0.00
Bowland Fringe and Pendle Hill	74100	443	0.60	21	0	21	0.95	0.01
Breckland	101923	881	0.86	57	24	77	1.75	0.02
Bristol, Avon Valleys and Ridges	84252	14603	17.33	379	67	425	0.58	0.10
Cannock Chase and Cank Wood	72771	28202	38.75	557	105	615	0.44	0.17
Carnmenellis	14327	133	0.93	4	0	4	0.60	0.01
Central Lincolnshire Vale	81895	90	0.11	22	2	24	5.33	0.01
Central North Norfolk	72044	3277	4.55	191	16	203	1.24	0.06
Charnwood	17457	1809	10.36	147	7	153	1.69	0.18
Cheshire Sandstone Ridge	22046	15	0.07	11	0	11	14.67	0.01
Cheviot Fringe	51579	0	0.00	0	0	0	0.00	0.00
Cheviots	36484	0	0.00	0	0	0	0.00	0.00
Chilterns	164110	14946	9.11	511	33	540	0.72	0.07
Clun and North West Herefordshire Hills	62488	0	0.00	0	0	0	0.00	0.00
Cornish Killas	222125	3831	1.72	513	82	574	3.00	0.05
Cotswolds	288173	4224	1.47	286	15	293	1.39	0.02
Cumbria High Fells	199009	98	0.05	22	0	22	4.49	0.00
Dark Peak	86604	631	0.73	126	19	138	4.37	0.03
Dartmoor	87394	0	0.00	0	0	0	0.00	0.00
Derbyshire Peak Fringe and Lower Derwent	37764	913	2.42	39	1	40	0.88	0.02
Devon Redlands	97405	4492	4.61	183	3	186	0.83	0.04
Dorset Downs and Cranborne Chase	116851	662	0.57	66	21	84	2.54	0.01
Dorset Heaths	61685	9126	14.79	263	15	275	0.60	0.09
Dunsmore and Feldon	70598	2646	3.75	199	99	241	1.82	0.07
Durham Coalfield Pennine Fringe	66138	2343	3.54	187	20	207	1.77	0.06
Durham Magnesian Limestone Plateau	45259	8906	19.68	243	13	253	0.57	0.11
East Anglian Chalk	83862	2371	2.83	80	1	80	0.67	0.02
Eden Valley	80968	354	0.44	34	0	34	1.92	0.01
Exmoor	130359	880	0.68	48	15	63	1.43	0.01
Forest Of Dean and Lower Wye	31386	366	1.17	16	0	16	0.87	0.01
Greater Thames Estuary	83670	10412	12.44	635	163	710	1.36	0.17
Hampshire Downs	148935	4312	2.90	293	66	345	1.60	0.05
Hensbarrow	11944	0	0.00	0	0	0	0.00	0.00
Herefordshire Lowlands	88684	1814	2.05	84	12	87	0.96	0.02
Herefordshire Plateau	34626	29	0.08	17	0	17	11.72	0.01
High Leicestershire	56862	400	0.70	54	5	59	2.95	0.02
High Weald	174876	7788	4.45	158	27	185	0.48	0.02
Holderness	87301	3746	4.29	237	16	244	1.30	0.06
Howardian Hills	24013	127	0.53	1	0	1	0.16	0.00

Howgill Fells	10359	0	0.00	0	0	0	0.00	0.00
Humber Estuary	27953	5633	20.15	72	15	73	0.26	0.05
Humberhead Levels	171805	4741	2.76	183	13	193	0.81	0.02
Inner London	33014	32165	97.43	65	0	65	0.04	0.04
Isle Of Porland	1122	180	16.04	11	0	11	1.22	0.20
Isle Of Wight	38037	1891	4.97	136	1	136	1.44	0.07
Kesteven Uplands	68998	658	0.95	31	0	31	0.94	0.01
Lancashire and Amounderness Plain	98565	12796	12.98	381	40	406	0.63	0.08
Lancashire Coal Measures	40588	13805	34.01	435	48	478	0.69	0.24
Lancashire Valleys	55425	9293	16.77	354	33	375	0.81	0.14
Leicestershire and Nottinghamshire Wolds	64067	1044	1.63	97	30	124	2.38	0.04
Leicestershire and South Derbyshire Coalfield	20460	1211	5.92	227	17	230	3.80	0.22
Leicestershire Vales	71801	10895	15.17	381	60	422	0.77	0.12
Lincolnshire Coast and Marshes	88202	3815	4.33	161	9	168	0.88	0.04
Lincolnshire Wolds	84485	147	0.17	23	1	24	3.27	0.01
Low Weald	182401	5787	3.17	371	57	416	1.44	0.05
Lundy	454	0	0.00	0	0	0	0.00	0.00
Malvern Hills	8329	77	0.92	8	0	8	2.08	0.02
Manchester Conurbation	34218	28015	81.87	141	12	149	0.11	0.09
Manchester Pennine Fringe	39299	20755	52.81	263	26	286	0.28	0.15
Marshwood and Powerstock Vales	15943	232	1.46	30	1	31	2.67	0.04
Mease/Sence Lowlands	32357	1280	3.96	52	1	53	0.83	0.03
Melbourne Parklands	15052	602	4.00	14	0	14	0.47	0.02
Mendip Hills	30300	295	0.97	23	9	31	2.10	0.02
Mersey Valley	44745	9807	21.92	377	27	388	0.79	0.17
Merseyside Conurbation	28658	20338	70.97	322	43	347	0.34	0.24
Mid Norfolk	90893	1989	2.19	139	15	153	1.54	0.03
Mid Northumberland	63728	319	0.50	21	1	22	1.38	0.01
Mid Severn Sandstone Plateau	88803	11068	12.46	373	28	392	0.71	0.09
Mid Somerset Hills	42080	404	0.96	18	0	18	0.89	0.01
Midvale Ridge	44503	4471	10.05	160	31	179	0.80	0.08
Morecambe Bay Limestones	39963	422	1.06	10	0	10	0.47	0.01
Morecambe Coast and Lune Estuary	13199	2149	16.28	52	3	55	0.51	0.08
Needwood and South Derbyshire Claylands	81528	3055	3.75	204	32	229	1.50	0.06
New Forest	73772	2693	3.65	158	13	167	1.24	0.05
North Downs	137459	8966	6.52	260	12	270	0.60	0.04
North East Norfolk and Flegg	24654	1077	4.37	26	1	27	0.50	0.02
North Kent Plain	84826	21502	25.35	494	75	546	0.51	0.13
North Norfolk Coast	6270	0	0.00	0	0	0	0.00	0.00
North Northumberland Coastal Plain	37665	158	0.42	0	0	0	0.00	0.00
North Pennines	214549	0	0.00	0	0	0	0.00	0.00
North West Norfolk	80130	152	0.19	40	0	40	5.26	0.01
North Yorkshire Moors and Cleveland Hills	165853	1890	1.14	81	6	85	0.90	0.01
Northamptonshire Uplands	101143	1703	1.68	135	47	166	1.95	0.03
Northamptonshire Vales	90391	7173	7.94	423	76	474	1.32	0.10
Northern Lincolnshire Edge With Coversands	50075	2775	5.54	133	3	135	0.97	0.05
Northern Thames Basin	251036	72423	28.85	1480	212	1554	0.43	0.12
Northumberland Sandstone Hills	72697	147	0.20	14	1	15	2.04	0.00
Nottinghamshire, Derbyshire &Yorkshire Coalfield	169783	47683	28.08	1531	164	1633	0.68	0.19
Orton Fells	29285	0	0.00	0	0	0	0.00	0.00
Oswestry Uplands	9985	246	2.46	15	0	15	1.22	0.03
Pennine Dales Fringe	87312	1926	2.21	51	4	55	0.57	0.01
Pevensey Levels	9639	2036	21.12	127	73	164	1.61	0.34
Potteries and Churnet Valley	53144	10148	19.10	291	19	301	0.59	0.11
Quantock Hills	7619	0	0.00	0	0	0	0.00	0.00
Rockingham Forest	50999	2652	5.20	97	22	112	0.84	0.04

Romney Marshes	36689	48	0.13	0	0	0	0.00	0.00
Salisbury Plain and West Wiltshire Downs	122310	1385	1.13	70	2	71	1.03	0.01
Sefton Coast	8983	2687	29.91	30	0	30	0.22	0.07
Severn and Avon Vales	210323	11226	5.34	559	55	597	1.06	0.06
Sherwood	53457	8764	16.39	196	6	199	0.45	0.07
Shropshire Hills	107967	218	0.20	43	1	43	3.94	0.01
Shropshire, Cheshire and Staffordshire Plain	366246	14558	3.97	951	106	1016	1.40	0.06
Solway Basin	98339	1864	1.90	67	10	74	0.79	0.02
Somerset Levels and Moors	65806	3288	5.00	183	26	190	1.16	0.06
South Coast Plain	52223	14714	28.18	486	11	495	0.67	0.19
South Cumbria Low Fells	69147	674	0.97	50	0	50	1.48	0.01
South Devon	121097	9547	7.88	255	16	260	0.54	0.04
South Downs	101846	7146	7.02	108	11	119	0.33	0.02
South East Northumberland Coastal Plain	43719	5541	12.67	230	49	273	0.99	0.12
South Hampshire Lowlands	38637	9625	24.91	362	72	422	0.88	0.22
South Herefordshire and Over Severn	51150	234	0.46	16	0	16	1.37	0.01
South Norfolk and High Suffolk Claylands	214499	645	0.30	167	16	180	5.58	0.02
South Purbeck	11849	211	1.78	9	1	10	0.95	0.02
South Suffolk and North Essex Clayland	329000	12872	3.91	768	97	819	1.27	0.05
South West Peak	42576	394	0.93	35	1	35	1.78	0.02
Southern Lincolnshire Edge	57046	606	1.06	210	13	220	7.26	0.08
Southern Magnesian Limestone	136746	9093	6.65	459	53	505	1.11	0.07
Southern Pennines	119693	5926	4.95	290	23	310	1.05	0.05
Suffolk Coast and Heaths	82115	4496	5.48	297	78	332	1.48	0.08
Tees Lowlands	102212	12742	12.47	361	96	426	0.67	0.08
Teme Valley	19307	0	0.00	0	0	0	0.00	0.00
Thames Basin Heaths	118520	12529	10.57	602	72	664	1.06	0.11
Thames Basin Lowlands	32793	16110	49.13	211	15	222	0.28	0.14
Thames Valley	86047	27076	31.47	624	53	651	0.48	0.15
The Broads	56298	1011	1.80	57	7	61	1.21	0.02
The Culm	283079	739	0.26	213	16	228	6.17	0.02
The Fens	382627	4680	1.22	476	53	506	2.16	0.03
The Lizard	14721	0	0.00	0	0	0	0.00	0.00
Trent and Belvoir Vales	177604	7535	4.24	285	15	298	0.79	0.03
Trent Valley Washlands	39390	6312	16.02	355	58	399	1.26	0.20
Tyne and Wear Lowlands	46404	19511	42.05	345	3	347	0.36	0.15
Tyne Gap and Hadrian's Wall	43414	407	0.94	36	8	38	1.87	0.02
Upper Thames Clay Vales	188976	8476	4.49	465	61	496	1.17	0.05
Vale Of Mowbray	60627	493	0.81	32	0	32	1.30	0.01
Vale Of Pickering	43081	474	1.10	39	1	40	1.69	0.02
Vale Of Taunton and Quantock Fringes	48400	1850	3.82	117	37	140	1.51	0.06
Vale Of York	102083	3567	3.49	222	40	259	1.45	0.05
Wealden Greensand	145805	8617	5.91	446	43	474	1.10	0.07
West Cumbria Coastal Plain	49292	3211	6.51	84	0	84	0.52	0.03
West Penwith	20201	170	0.84	28	0	28	3.29	0.03
Weymouth Lowlands	13262	1073	8.09	17	1	18	0.34	0.03
White Peak	52871	415	0.78	16	0	16	0.77	0.01
Wirral	16523	2893	17.51	98	1	98	0.68	0.12
Yardley-Whittlewood Ridge	33785	179	0.53	42	0	42	4.69	0.02
Yeovil Scarplands	78586	1306	1.66	106	20	124	1.90	0.03
Yorkshire Dales	239970	304	0.13	26	0	26	1.71	0.00
Yorkshire Southern Pennine Fringe	58513	19148	32.72	510	24	525	0.55	0.18
Yorkshire Wolds	111415	190	0.17	93	14	98	10.32	0.02
Total	**13043774**	**877372**	**6.73**	**30068**	**3924**	**32593**	**0.74**	**0.05**

3.24 For this reason an overall indicator of change in non-residential facilities has been constructed by first calculating the absolute change in numbers of units that would be expected in each tile if the number of units had grown in the years 1998-2003 at the national rate. Comparison of actual change and this expectation generates the grid **Npafnetch800** illustrated in Figure 3.9, which highlights areas where businesses were being lost and important areas of new non-domestic development. Overall the number of non-residential delivery points at cell level increased by 4.798% over this period (which forms the basis for the expectation.

3.25 This grid immediately highlights new business and leisure development around small and medium sized towns. Of particular note is growth on the fringe of Milton Keynes (Bedfordshire and Cambridgeshire Claylands JCA), Northampton (Northamptonshire Vales JCA), Telford (Mid Severn Sandstone Plateau, and Shropshire, Cheshire and Staffordshire Plain JCAs), Peterborough (Bedfordshire and Cambridgeshire Claylands JCA), and Ashford (Wealden Greensand, and Low Weald JCAs); all growth areas within the current planning policy regime. Alongside such centres, similar rates of non-domestic development are found around York (Vale of York JCA), Lincoln (Trent and Belvoir Vales, Southern Lincolnshire Edge, and Northern Lincolnshire Edge with Coversands JCAs), Grantham (Trent and Belvoir Vales JCA), Sleaford (Southern Lincolnshire Edge JCA), Braintree (South Suffolk and North Essex Clayland JCA), Weston-Super Mare (Somerset Levels and Moors JCA), Bristol's north fringe (Bristol, Avon Valleys and Ridges JCA), and Trowbridge (Avon Vale JCA).

3.26 Drawing inferences about non-residential development from PAF is inevitably more complex than drawing parallel inferences about residential use because of the highly variable natures of non-residential uses themselves. It is also more difficult for OS or its contractors to apply non-residential LUCS categories consistently, and it is far more difficult for those who use LUCS data to visualize the corresponding developments.. LUCS provides estimates of site area rather than units of floor space (which are typically used in the property industry). LUCS is readily suited to charting the total area of land (within a JCA for example) which might be changing to or from a particular use, but it may be very difficult to understand what this might imply for landscape character and quality. The impact of any such change might reasonably be expected to depend upon the physical configuration of such an aggregate. Construction of major retail parks at the urban edge might be thought to have a more marked impact than diffuse development of small shop units. LUCS cannot however, directly identify the nature of the property objects being gained or lost.

3.27 Interpretation of the pointers to non-residential development provided by either LUCS or PAF may thus be troublesome. In order to make the most of these data, it proves useful to combine the richness of meaning encoded in the textual data of PAF and the detailed estimates of site size and character recorded in LUCS. The strengths and weaknesses of the two data sets with respect to non-residential development are clearly complementary. It is difficult to infer the extent of such property from a postal address , and equally difficult to infer the character of a development from its LUCS use code(s) (eg L).

Figure 3.8: Density of Business Addresses (Non-domestic Delivery Points) PAF, 2003 (units per hectare) (grid = **Npaf2003**)

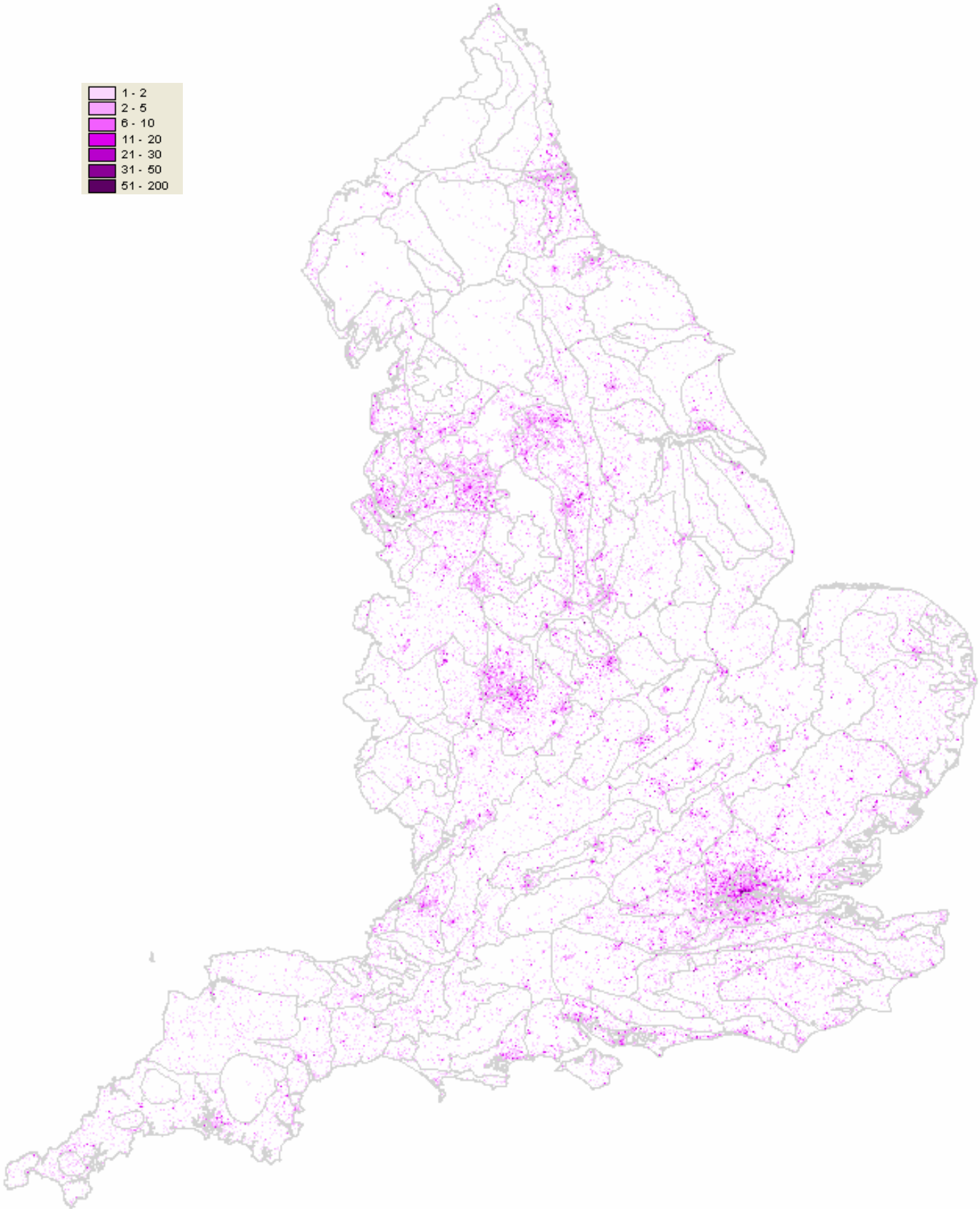
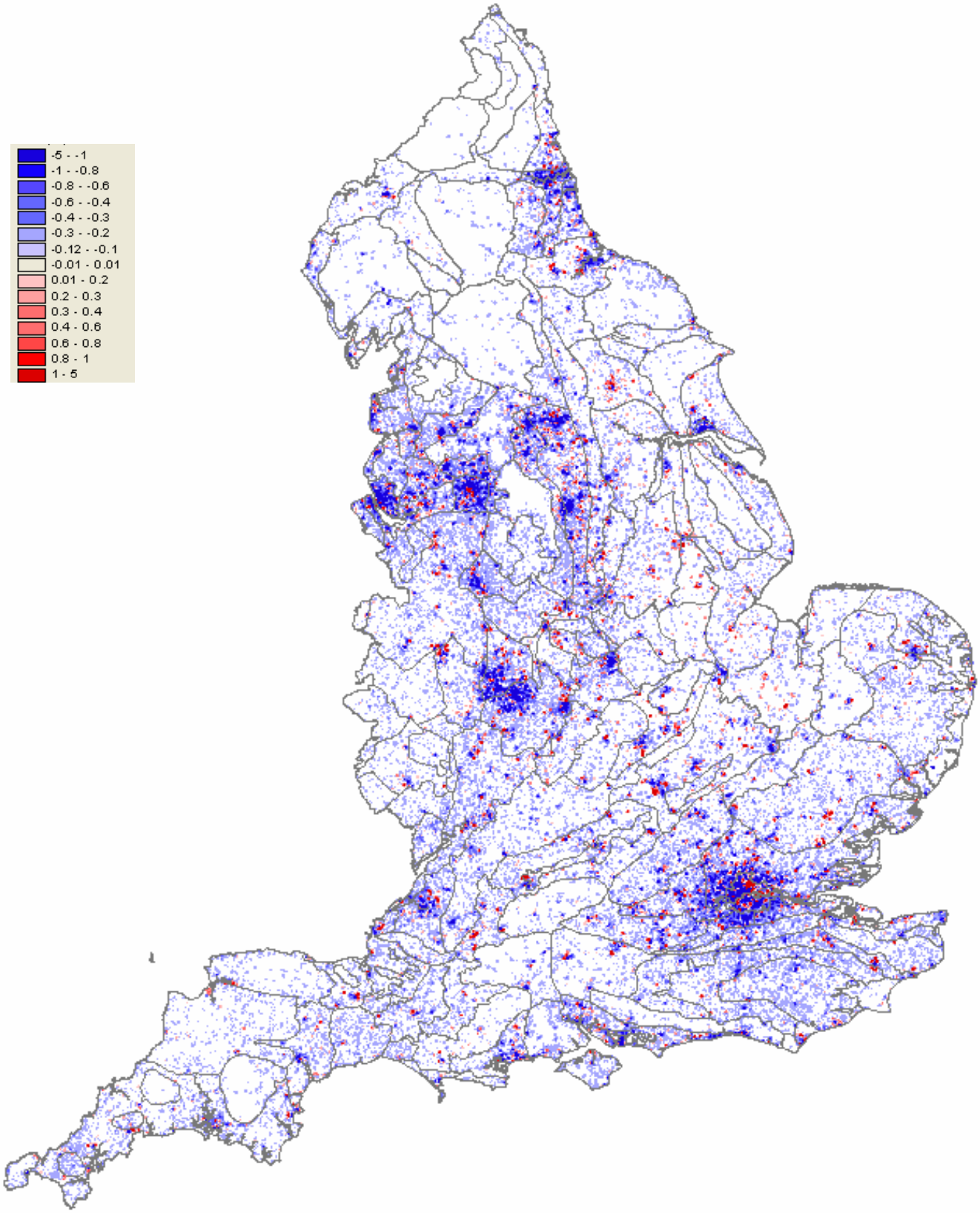


Figure 3.8 shows in increasing intensity of purple the number of business addresses in each hectare cell in 2003 (the end of the study period).

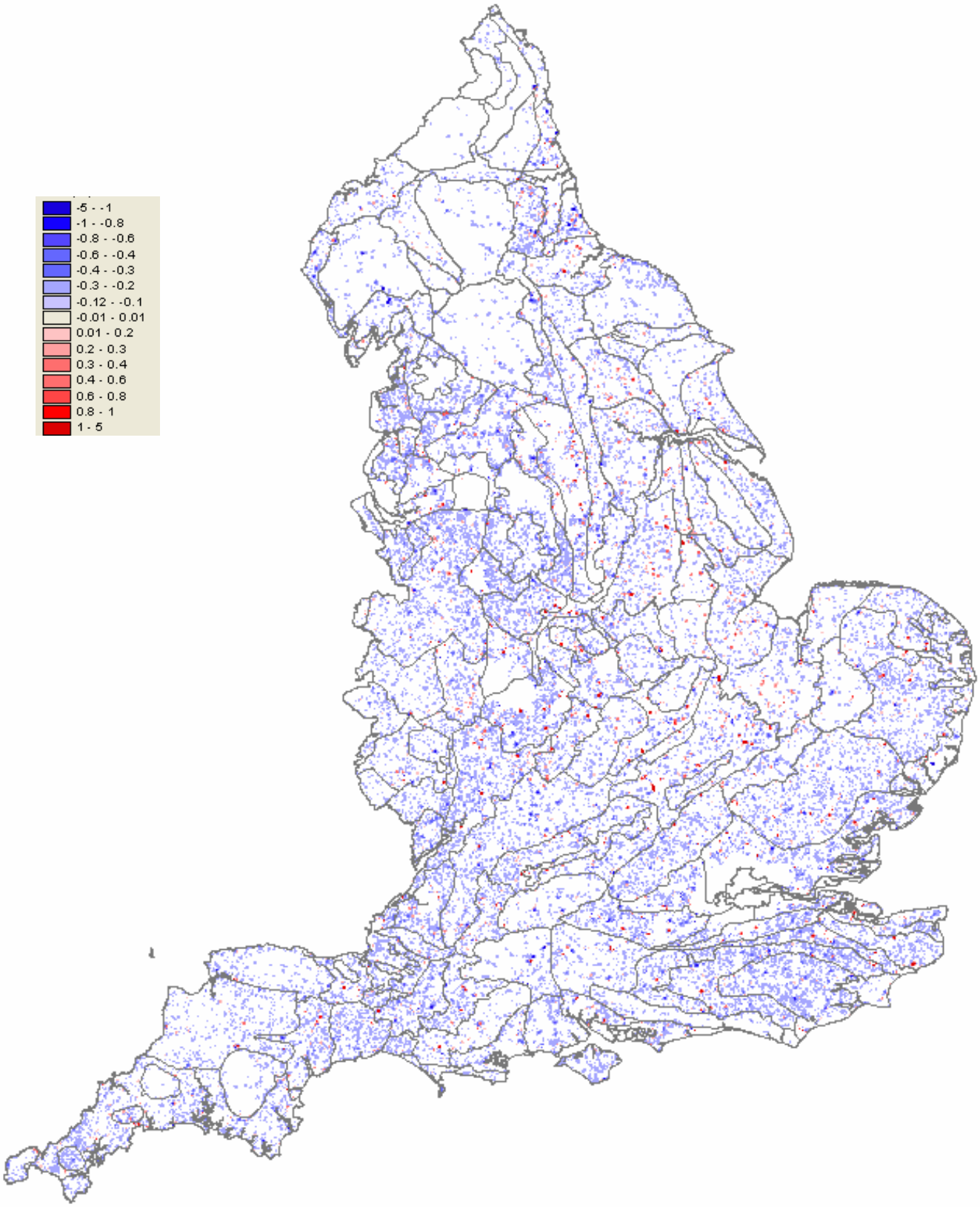
Figure 3.9a: Change in Non-Residential Property, 1998 -2003 (units per hectare) (grid = **Npafnetch800**)



a) For England

Figure 3.9 a shows change in business addresses in each hectare tile in the years 1998 to 2003. Increasing intensities of red in a tile indicate an excess of business addresses over the number that would be expected had it been subject to growth at the national rate. (This might be due to new construction or change of use). Increasing intensities of blue show identify tiles which have grown at less than the national rate. Falls may result from demolitions, changes of use or increasing vacancy).

Figure 3.9b: Change in Non-Residential Property, 1998 to 2003 (units per hectare) (grid = **Npafnetch800**)



b) English rural domain only

Figure 3.9 b shows change in business addresses in each hectare tile in the years 1998 to 2003 (excluding urban areas with a population of 10,000 or more). Increasing intensities of red in a tile indicate an excess of business addresses over the number that would be expected had it been subject to growth at the national rate. (This might be due to new construction or change of use). Increasing intensities of blue show identify tiles which have grown at less than the national rate. (Falls may result from demolitions, changes of use or increasing vacancy).

Non Residential Development Units

3.28 A very first step in mitigating the difficulties discussed above entails attempting to infer the pattern of new property objects *implied* by LUCS, combining LUCS records as necessary. This is a fairly complex process, and for the purposes of this study is guided by inferences drawn from PAF data using natural language processing. Technically, it involves first building a 'tree' capturing change to particular land uses across the country, then building another 'tree' summarising the pattern of property objects implied by changes in postal addresses, and finally bringing the two trees together. This very general method provides a major enhancement of the usefulness of LUCS (and PAF) data as it allows any LUCS quanta (such as 1.2ha of K) to be represented as an object (such as a 'retail park') (see Figures 3.10 and 3.11).

3.29 While charting gains and losses of property objects is attractive in principle (and more relevant to appreciating the nature of landscape change than recording change in areas typified by 24 land-use codes), it presupposes agreement over a set of land-use or property objects. More formally, it presupposes an *ontology* of land-use or property objects (that is to say, an explicit description of the objects, concepts, and other entities that are assumed to exist and the relationships that hold among them (Genesereth & Nilsson, 1987)). Attempting to examine issues of land-use and landscape change computationally brings such issues into high relief. Resolution of immediate practical issues such as drawing inferences from addresses demands conceptual clarification. While broader aspects of the overall work of conceptual clarification are taken somewhat further in Section 4, the present section attempts to illustrate some of the issues through concrete examples.

3.30 The approach taken here to combining LUCS and PAF data depends upon specifying (as part of an ontology) explicit semantic structures – meronymies and hyponomies to govern the process of combination. A *meronymy* specifies what may be held to form *part* of what. A car park and access roads may form part of a retail park for example and so T (transport) and H (highways) uses in LUCS might be considered to form part of a retail park (provided K (retail) uses also occur *within a particular distance).* Such common sense knowledge can be specified in rules, such as :

```
mer([k],[a1park],lucspark).
mer([t],[transport],lucspark).
mer([u],[urban],lucspark).
mer([transport],[b1park],lucspark).
mer([transport],[a1park],lucspark).
mer([transport],[b8park],lucspark).
```

which encapsulate (inter alia) the remarks above. Rules such as these allow for simultaneous spatial and categorical generalization of LUCS records.

3.31 It should be stressed that these rules are non-deterministic. Change to transport use does not *of necessity* imply establishment or expansion of a business park. In the example above, land under transport use (itself a combination of H and T) could form part of a business park (in Town and Country Planning Use Class B1), of a retail park (in Town and Country Planning Use Class A1), or of a distribution park (in Town and Country Planning Use Class B8). The present approach also allows that it might be part of none of these.

3.32 To disentangle these possibilities in order to infer change in property objects, changing entrants within PAF are considered. As indicated in para 3.19, in the years 1998 to 2003 more than 2000 new entries in the thoroughfare fields appeared in PAF, representing objects of significantly different character. These included 344 referents dubbed 'business, park,' 318 dubbed 'industrial estate', 79 described as 'business centre', 72 as 'retail park,' and 64 as 'trading estate.' It would be reasonable to expect a correspondence between change indicated by LUCS and that implied by PAF.

3.33 To exploit this expectation, the next step is to specify the second sort of hierarchical structure – one of hyponyms (subsets) and hypernyms (supersets). This second form of hierarchical classification is familiar in many areas (eg the Standard Industrial Classification or the NMR thesaurus). Within the framework developed within TRP at Sheffield, many such hierarchies are used, reflecting differences in purpose. To classify non-residential development units, for the current purpose a set of rules is deployed such as

```
hyp([business, park],[b1park],pbpark).
hyp([business, centre],[b1park],pbpark).
hyp([business, estate],[b1park],pbpark).
hyp([business, units],[b1park],pbpark).
hyp([commerce, park],[b1park],pbpark).
hyp([commercial, estate],[b1park],pbpark).
hyp([corporate, park],[b1park],pbpark).
hyp([designer, outlet],[a1park],pbpark).
hyp([designer, village],[a1park],pbpark).
hyp([distribution, centre],[b8park],pbpark).
hyp([distribution, park],[b8park],pbpark).
hyp([employment, park],[b1park],pbpark).
hyp([energy, park],[b1park],pbpark).
hyp([enterprise, park],[b1park],pbpark).
hyp([executive, park],[b1park],pbpark).
hyp([freight, terminal],[b8park],pbpark).
hyp([health, park],[c1park],pbpark).
hyp([industrial, estate],[b1park],pbpark).
hyp([industrial, park],[b1park],pbpark).
hyp([international, business, park],[b1park],pbpark).
hyp([leisure, complex],[lpark],pbpark).
hyp([leisure, park],[lpark],pbpark).
hyp([office, park],[b1park],pbpark).
hyp([office, village],[b1park],pbpark).
hyp([outlet, village],[a1park],pbpark).
hyp([outlet],[a1park],pbpark).
hyp([research, park],[b1park],pbpark).
hyp([retail, park],[a1park],pbpark).
hyp([science, park],[b1park],pbpark).
hyp([shopping, centre],[a1park],pbpark).
hyp([shopping, park],[a1park],pbpark).
hyp([technology, park],[b1park],pbpark).
hyp([trade, park],[b1park],pbpark).
hyp([trading, estate],[b1park],pbpark).
hyp([warehouse, park],[b1park],pbpark).
hyp([b1park],[park],pbpark).
hyp([a1park],[park],pbpark).
hyp([b8park],[park],pbpark).
hyp([lpark],[park],pbpark).
```

3.34 These may be read as specifying (in the example of the first clause listed) that a business park is to be understood as a type of B1 park (a reference to the Town and Country Planning Use Class) under a classifactory scheme called 'pbpark.' By parsing the new thoroughfare fields appearing on PAF between 1998 and 2003, it is possible to identify the terms by which new property objects have been named (eg 'enterprise park' or 'industrial estate') and assign them to broader categories such as B1 park. (It should be appreciated that within the framework developed this process of identifying ever broader categories may use multiple hierarchies. Thus it is possible to integrate facts such as

```
hyp([business, park], [commercial, monument], nmr).
```

recording the fact that a business park is a type of commercial monument within the National Monument Record's Thesaurus.

3.35 By building rules which incorporate terms from both PAF and LUCS, it is possible to identify units of development in a substantively meaningful manner. Having identified new non-residential property objects in this way, it is still necessary to examine their relation to the contiguous urban area. For this purpose a measure of the contiguous urban area as of 1998 is approximated by finding the geometric union of the simulated urban area at that time and the non-residential urban area which includes major industrial sites, docks, and urban fringe airports for example. This measure of non-residential urban area is derived by comparing the simulated urban area with the OS areas of urban land for 2001 (with a population over 2000). (It should be noted that the nature of the definition of simulated areas is such that commercial and retail cores are in fact included in view of the density of residential property that typically surrounds them. Provision to deal with non-residential urban areas is required solely to deal with extensive un-populated parts of the contiguous urban area such as Heathrow, Manchester and Birmingham airports, Immingham Docks, and petrochemical establishments at Ellesmere Port).

3.36 Having defined the 1998 contiguous urban area in this manner, a search buffer was defined around it extending 400 metres beyond the urban edge. New non-residential property objects have been treated as extending the contiguous urban area if they fall within this buffer.

3.37 Having identified both new residential enclaves at the urban fringe and new non-residential facilities such as business or leisure parks, these have been combined to produce an indicator of growth at the urban fringe. In this way it is possible to indicate for any urban area (or JCA – Table 3.4) the number and mix of new property objects constructed and the overall extent of contiguous urban growth. Growth of the contiguous urban area is estimated by first identifying an appropriate tract of land at the urban fringe, and then simply adding the residential and non-residential components to produce the grid **Composite_ind** (illustrated in Figure 3.12).

Figure 3.10: Retail, Business, Leisure and Distribution Parks Developed 1998-2003 (grid = **Park_type**)

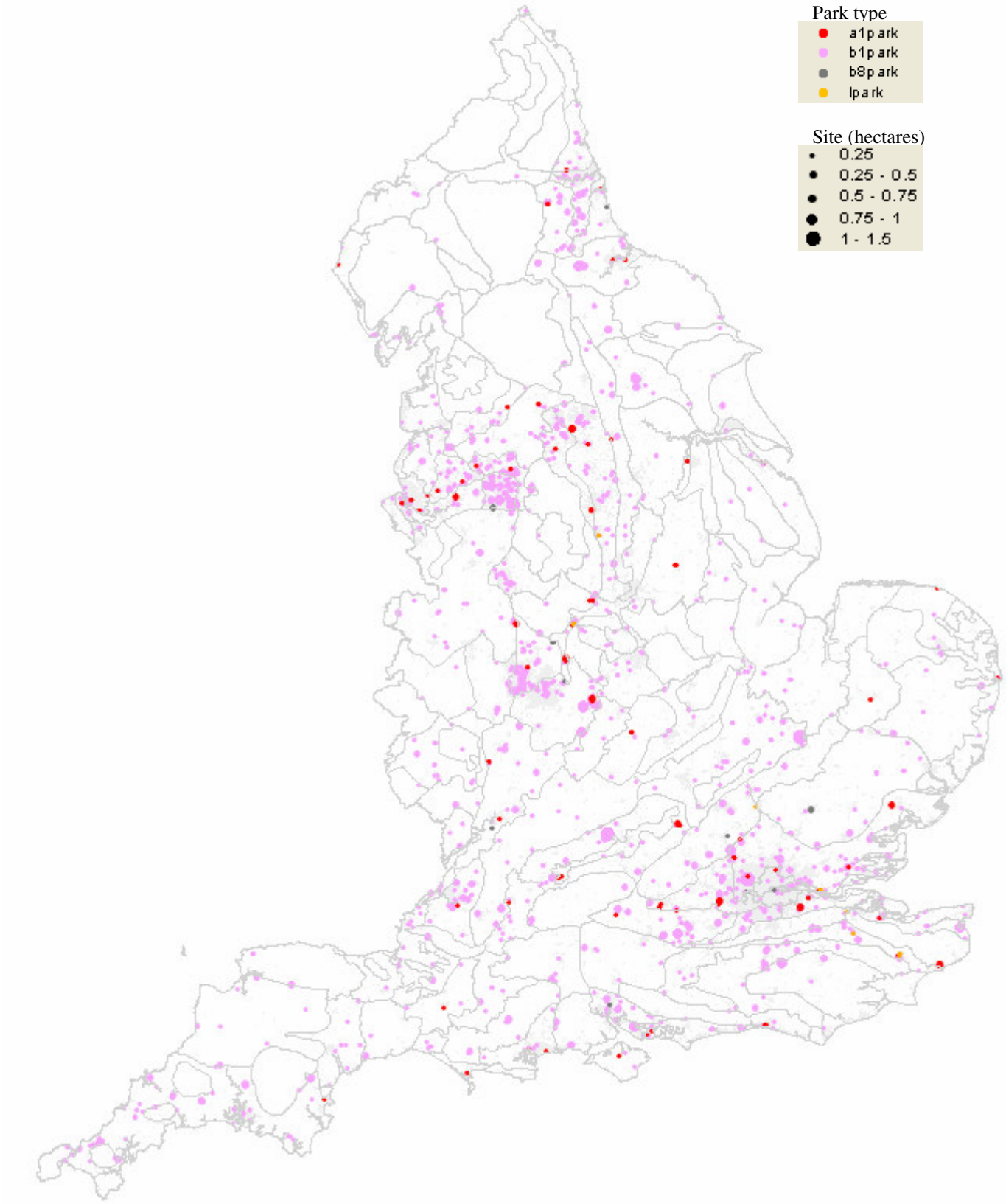


Figure 3.11: Retail, Business, Leisure and Distribution Parks Developed 1998-2003 in the Non-Urban extent, 1998 (grid = **Park_type**)

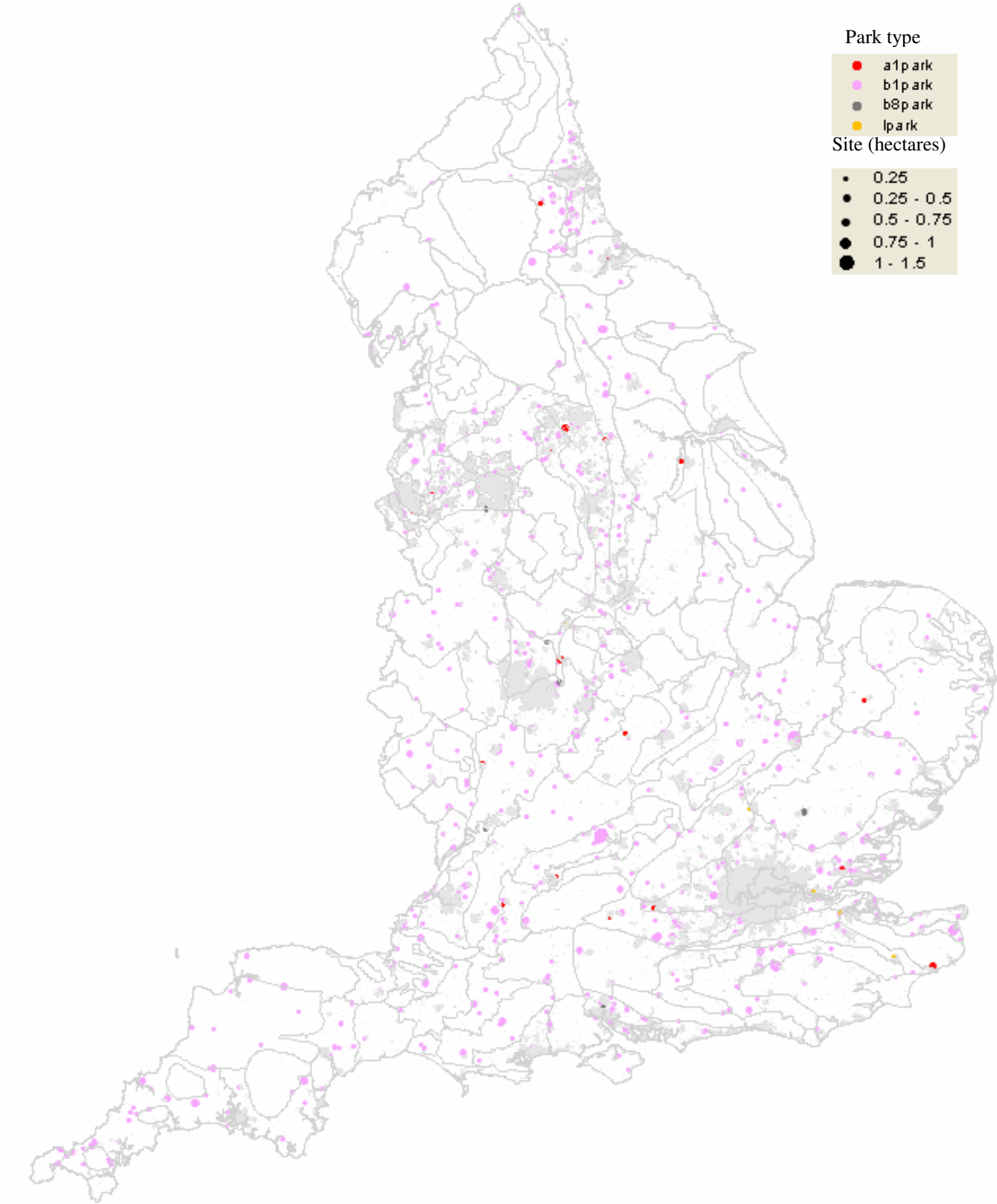
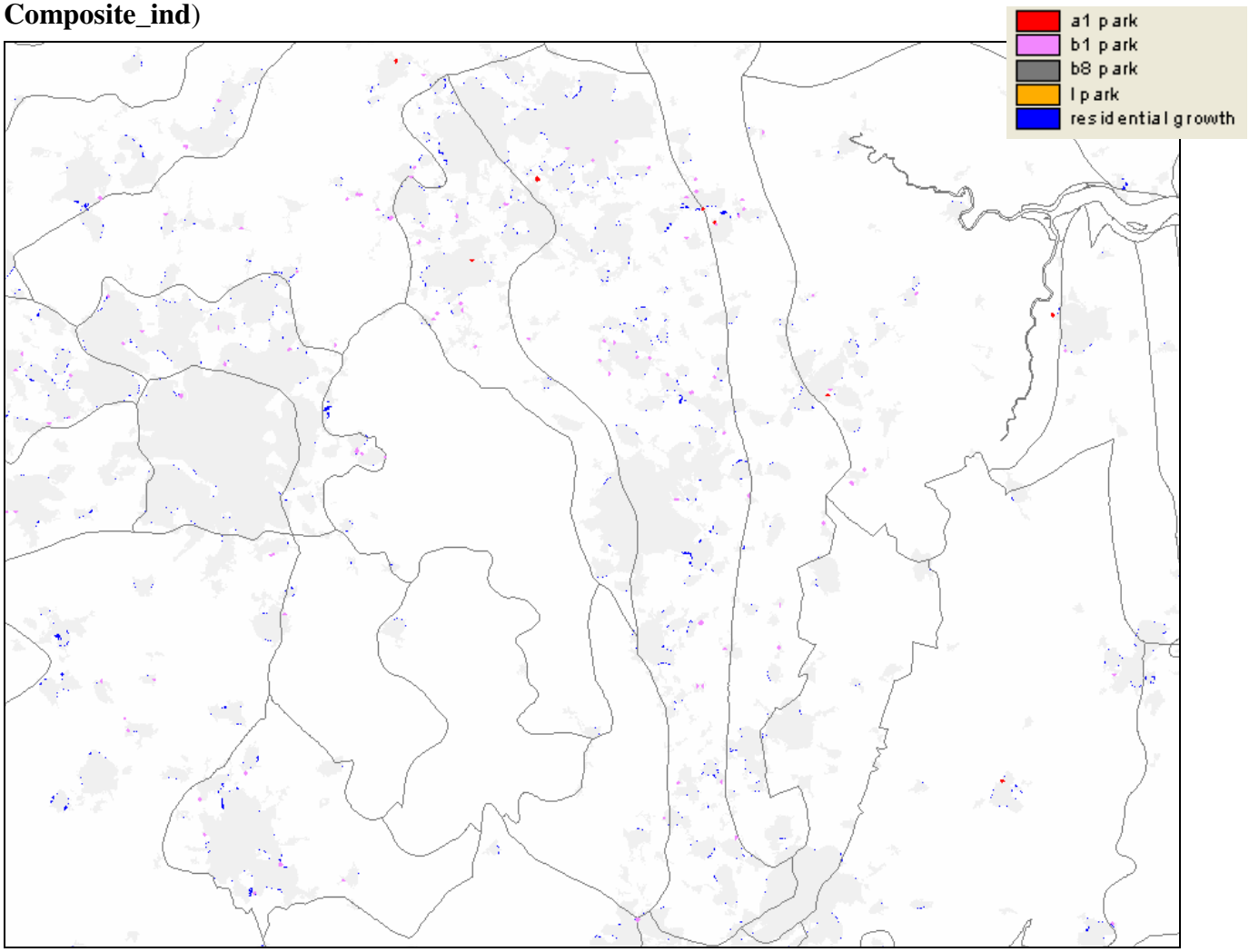
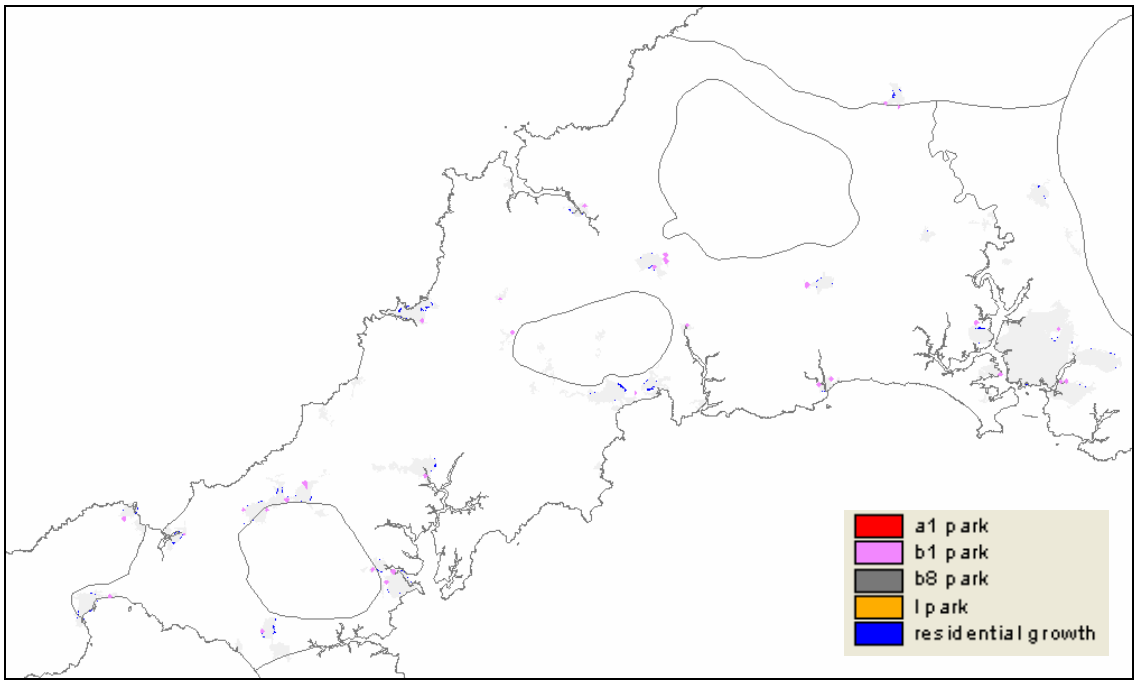


Figure 3.12: Composite Indicator of Growth of Contiguous Urban Area (grid = **Composite_ind**)



a) Nottinghamshire, Derbyshire &Yorkshire Coalfield and surrounding JCAs



b) The Cornish Killas

Table 3.4: Composite Indicator of Growth of Contiguous Urban Area by JCA

JCA	Fringe non-residential park growth		Residential growth	
	has	JCA share (%)	has	JCA share (%)
Arden	14	1.41	846	2.60
Avon Vale	10	1.01	361	1.11
Bedfordshire and Cambridgeshire Claylands	28	2.83	889	2.73
Bedfordshire Greensand Ridge	3	0.30	89	0.27
Berkshire and Marlborough Downs	5	0.50	127	0.39
Black Mountains and Golden Valley	0	0.00	0	0.00
Blackdowns	2	0.20	104	0.32
Blackmoor Vale and The Vale Of Wardour	4	0.40	65	0.20
Bodmin Moor	0	0.00	0	0.00
Border Moors and Forests	0	0.00	0	0.00
Bowland Fells	0	0.00	0	0.00
Bowland Fringe and Pendle Hill	0	0.00	21	0.06
Breckland	2	0.20	77	0.24
Bristol, Avon Valleys and Ridges	15	1.51	424	1.30
Cannock Chase and Cank Wood	14	1.41	615	1.89
Carnmenellis	3	0.30	4	0.01
Central Lincolnshire Vale	1	0.10	24	0.07
Central North Norfolk	2	0.20	203	0.62
Charnwood	5	0.50	152	0.47
Cheshire Sandstone Ridge	0	0.00	11	0.03
Cheviot Fringe	0	0.00	0	0.00
Cheviots	0	0.00	0	0.00
Chilterns	11	1.11	540	1.66
Clun and North West Herefordshire Hills	0	0.00	0	0.00
Cornish Killas	42	4.24	572	1.76
Cotswolds	14	1.41	293	0.90
Cumbria High Fells	1	0.10	22	0.07
Dark Peak	0	0.00	138	0.42
Dartmoor	1	0.10	0	0.00
Derbyshire Peak Fringe and Lower Derwent	1	0.10	40	0.12
Devon Redlands	8	0.81	186	0.57
Dorset Downs and Cranborne Chase	8	0.81	84	0.26
Dorset Heaths	9	0.91	275	0.84
Dunsmore and Feldon	13	1.31	241	0.74
Durham Coalfield Pennine Fringe	25	2.52	204	0.63
Durham Magnesian Limestone Plateau	8	0.81	253	0.78
East Anglian Chalk	1	0.10	80	0.25
Eden Valley	3	0.30	34	0.10
Exmoor	1	0.10	63	0.19
Forest Of Dean and Lower Wye	8	0.81	16	0.05
Greater Thames Estuary	23	2.32	710	2.18
Hampshire Downs	3	0.30	345	1.06
Hensbarrow	0	0.00	0	0.00
Herefordshire Lowlands	7	0.71	86	0.26
Herefordshire Plateau	4	0.40	17	0.05
High Leicestershire	0	0.00	59	0.18
High Weald	11	1.11	184	0.57
Holderness	0	0.00	244	0.75
Howardian Hills	0	0.00	1	0.00
Howgill Fells	0	0.00	0	0.00
Humber Estuary	0	0.00	73	0.22

Humberhead Levels	14	1.41	193	0.59
Inner London	0	0.00	65	0.20
Isle Of Porland	2	0.20	11	0.03
Isle Of Wight	1	0.10	136	0.42
Kesteven Uplands	1	0.10	31	0.10
Lancashire and Amounderness Plain	11	1.11	406	1.25
Lancashire Coal Measures	14	1.41	477	1.47
Lancashire Valleys	15	1.51	375	1.15
Leicestershire and Nottinghamshire Wolds	0	0.00	124	0.38
Leicestershire and South Derbyshire Coalfield	4	0.40	229	0.70
Leicestershire Vales	5	0.50	422	1.30
Lincolnshire Coast and Marshes	1	0.10	168	0.52
Lincolnshire Wolds	2	0.20	24	0.07
Low Weald	10	1.01	416	1.28
Lundy	0	0.00	0	0.00
Malvern Hills	0	0.00	8	0.02
Manchester Conurbation	4	0.40	149	0.46
Manchester Pennine Fringe	15	1.51	286	0.88
Marshwood and Powerstock Vales	4	0.40	31	0.10
Mease/Sence Lowlands	4	0.40	53	0.16
Melbourne Parklands	0	0.00	14	0.04
Mendip Hills	0	0.00	31	0.10
Mersey Valley	7	0.71	388	1.19
Merseyside Conurbation	6	0.61	346	1.06
Mid Norfolk	3	0.30	153	0.47
Mid Northumberland	0	0.00	22	0.07
Mid Severn Sandstone Plateau	4	0.40	392	1.20
Mid Somerset Hills	4	0.40	18	0.06
Midvale Ridge	0	0.00	179	0.55
Morecambe Bay Limestones	2	0.20	10	0.03
Morecambe Coast and Lune Estuary	0	0.00	55	0.17
Needwood and South Derbyshire Claylands	5	0.50	229	0.70
New Forest	5	0.50	167	0.51
North Downs	3	0.30	270	0.83
North East Norfolk and Flegg	0	0.00	27	0.08
North Kent Plain	19	1.92	546	1.68
North Norfolk Coast	0	0.00	0	0.00
North Northumberland Coastal Plain	3	0.30	0	0.00
North Pennines	0	0.00	0	0.00
North West Norfolk	0	0.00	40	0.12
North Yorkshire Moors and Cleveland Hills	0	0.00	85	0.26
Northamptonshire Uplands	4	0.40	163	0.50
Northamptonshire Vales	9	0.91	473	1.45
Northern Lincolnshire Edge With Coversands	1	0.10	135	0.41
Northern Thames Basin	26	2.62	1553	4.77
Northumberland Sandstone Hills	0	0.00	15	0.05
Nottinghamshire, Derbyshire &Yorkshire Coalfield	39	3.94	1633	5.02
Orton Fells	0	0.00	0	0.00
Oswestry Uplands	0	0.00	15	0.05
Pennine Dales Fringe	4	0.40	55	0.17
Pevensey Levels	1	0.10	164	0.50
Potteries and Churnet Valley	11	1.11	300	0.92
Quantock Hills	0	0.00	0	0.00
Rockingham Forest	2	0.20	112	0.34

Romney Marshes	0	0.00	0	0.00
Salisbury Plain and West Wiltshire Downs	7	0.71	68	0.21
Sefton Coast	1	0.10	30	0.09
Severn and Avon Vales	21	2.12	595	1.83
Sherwood	0	0.00	199	0.61
Shropshire Hills	1	0.10	43	0.13
Shropshire, Cheshire and Staffordshire Plain	28	2.83	1016	3.12
Solway Basin	0	0.00	74	0.23
Somerset Levels and Moors	16	1.61	190	0.58
South Coast Plain	11	1.11	494	1.52
South Cumbria Low Fells	4	0.40	50	0.15
South Devon	12	1.21	260	0.80
South Downs	0	0.00	119	0.37
South East Northumberland Coastal Plain	9	0.91	273	0.84
South Hampshire Lowlands	15	1.51	420	1.29
South Herefordshire and Over Severn	2	0.20	16	0.05
South Norfolk and High Suffolk Claylands	1	0.10	180	0.55
South Purbeck	0	0.00	10	0.03
South Suffolk and North Essex Clayland	19	1.92	818	2.51
South West Peak	1	0.10	35	0.11
Southern Lincolnshire Edge	2	0.20	220	0.68
Southern Magnesian Limestone	15	1.51	504	1.55
Southern Pennines	19	1.92	309	0.95
Suffolk Coast and Heaths	4	0.40	332	1.02
Tees Lowlands	12	1.21	426	1.31
Teme Valley	2	0.20	0	0.00
Thames Basin Heaths	30	3.03	661	2.03
Thames Basin Lowlands	6	0.61	222	0.68
Thames Valley	17	1.72	651	2.00
The Broads	0	0.00	61	0.19
The Culm	13	1.31	228	0.70
The Fens	13	1.31	506	1.55
The Lizard	0	0.00	0	0.00
Trent and Belvoir Vales	7	0.71	298	0.92
Trent Valley Washlands	12	1.21	399	1.23
Tyne and Wear Lowlands	14	1.41	347	1.07
Tyne Gap and Hadrian's Wall	2	0.20	38	0.12
Upper Thames Clay Vales	28	2.83	493	1.51
Vale Of Mowbray	12	1.21	32	0.10
Vale Of Pickering	2	0.20	40	0.12
Vale Of Taunton and Quantock Fringes	1	0.10	140	0.43
Vale Of York	4	0.40	259	0.80
Wealden Greensand	22	2.22	473	1.45
West Cumbria Coastal Plain	8	0.81	84	0.26
West Penwith	2	0.20	28	0.09
Weymouth Lowlands	0	0.00	18	0.06
White Peak	0	0.00	16	0.05
Wirral	0	0.00	98	0.30
Yardley-Whittlewood Ridge	0	0.00	42	0.13
Yeovil Scarplands	5	0.50	124	0.38
Yorkshire Dales	1	0.10	26	0.08
Yorkshire Southern Pennine Fringe	15	1.51	525	1.61
Yorkshire Wolds	0	0.00	98	0.30
Total	991	100	32554	100

Development in the Broader Countryside

3.38 While development at the urban fringe has a clear impact on countryside character and quality, the impact of change within the broader countryside is more subtle and much less well understood. It is clear, however, that the broader countryside is not left unaffected. Once again, it is convenient to consider residential development first. Indeed, in relative terms, Table 3.1 shows that some of the most marked growth in numbers of dwellings has been in the very smallest settlements, with units of occupation in isolated farmsteads increasing by 5.6%, and those in hamlets increasing by 8.9% relative to the stocks in 1998. Clearly this is a form of 'urbanization' quite distinct from growth at the urban fringe, in which entirely new construction plays a lesser role and in which different actors are involved (excluding volume housebuilders for example).

3.39 To appreciate how development pressures express themselves in the countryside it is useful to construct grids which clearly distinguish growth at the urban margin from development in the broader countryside. This has been done (arithmetically) by subtracting the net change in dwellings at the urban margin (fringe and periurban zones) from net change in dwellings outside the 1998 urban areas. Of course, (as Table 3.1 indicates) much of this net change does not involve new building, but depends on reorganization of existing buildings. Such reorganization allows highly flexible (although somewhat spatially incoherent) responses to housing market pressures. Table 3.2b summarizes residential change in the broader countryside at the JCA level. As JCAs differ greatly in their size and shape, and many individual JCAs may face a range of housing market pressures it is useful to produce a grid which shows net change in dwellings abstracting from growth in the urban areas and at their margin. By generalizing to the 10km scale, to generate the grid **Rstocknetc10k**, quite striking patterns are revealed (evident in Figure 3.13, which assist in the interpretation of Table 3.2b).

3.40 Figure 3.13 is highlight areas where countryside character might potentially be changing not because of the expansion of the contiguous urban area, but through intensification of use of rural settlements. Figure 3.13 does no distinguish intensification in the broader countryside attributable to the new building from that due to intensification of use of existing property. It highlights most clearly the increasing numbers of households in those JCAs that adjoin the West and South Yorkshire conurbations. This tendency must be seen alongside the trend toward the disintensification of some of the northern conurbations.

3.41 Across much of England there appears to be no such tendency to intensification in the broader countryside. Areas which show no sign of intensification include much of the Cotswolds JCA, and Salisbury Plain and the West Wiltshire Downs JCA. Many tracts of upland of high landscape quality show no tendency to intensification (including the Cheviots and the Cheviot Fringe JCAs, the North Yorkshire Moors and Cleveland Hills JCA, the Cumbria High Fells JCA, the North Pennines JCA, the Bowland Fells JCA, andthe Dartmoor JCA).

3.42 Several areas of which do show a tendency to intensification and which have no simple relationship to change in nearby conurbations are, however, highlighted in Figure 3.13. A series of tighter foci are clearly apparent. Each of the circles evident in Figure 3.13 covers an area of 314 square kms, and the scale shows net gain in dwellings per square

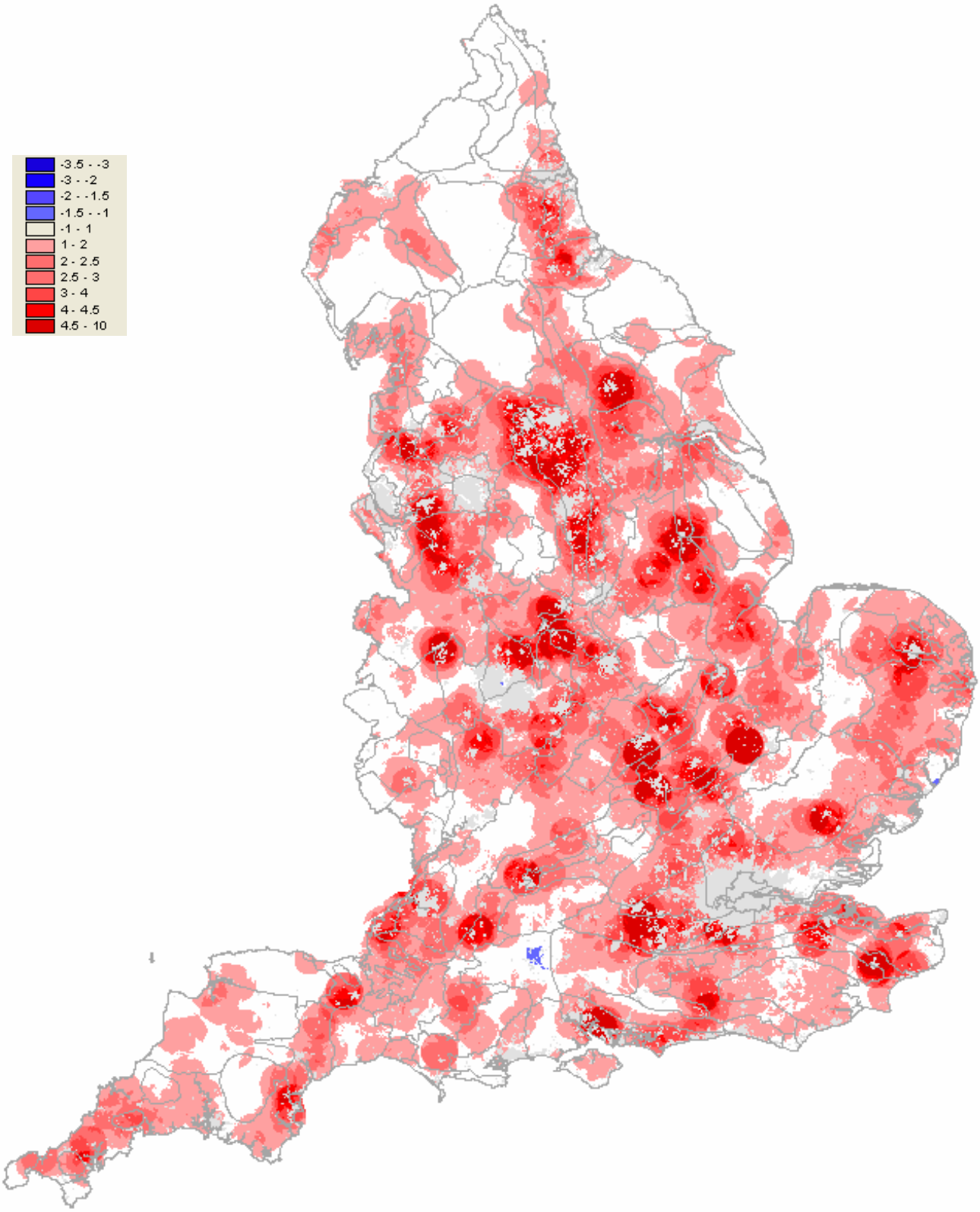
kilometre. Some of these foci might be regarded as the rural environs of planned growth points or growing towns. The areas around Milton Keynes (Bedfordshire and Cambridgeshire Claylands JCA), Ashford (Wealden Greensand, and Low Weald JCAs), and Telford (Mid Severn Sandstone Plateau, and Shropshire, Cheshire and Staffordshire Plain JCAs) are of this type. The environs of Trowbridge (Avon Vale JCA), Swindon (Midvale Ridge, and Upper Thames Clay Vales JCAs), York (Vale of York JCA), Lincoln (Central Lincolnshire Vale, Northern Lincolnshire Edge with Coversands, Southern Lincolnshire Edge, and Trent and Belvoir Vales JCAs), themselves growing towns, show similarly marked growth. A very few broader areas show sustained growth such as the Cornish Killas, Carnmenellis, Hensbarrow and West Penwith JCAs in the South West Peninsula and The Fens JCA.

3.43 Other areas of intensification in the broader countryside cannot be readily understood in this way, but should probably be understood in terms of their accessibility to more distant locations. A glance at Figure 3.13 suggests the possible importance of the M5 corridor to the South West of Bristol. A more sustained examination indicates that this area stretches along the rail corridor from Bristol to Exeter and beyond. Access to other rail routes may be significant in understanding the increase in dwellings in the countryside; most notably in Southern Railway route from London to Portsmouth via Horsham and the Arun Valley. Further examination underscores the possible relation between long distance rail accessibility and growth in the dwelling stock. The influence of the West Coast Main Line can be discerned (within a 10km drive of Crewe, Warrington, Preston, Lancaster and Penrith). The effect extends from Lancaster to Barrow-in-Furness; through the Morecambe Coast and Lune Estuary, Morecambe Bay Limestones and West Cumbria Coastal Plain JCAs. Similar effects are found around stations on the London to Norwich route (particularly in the South Norfolk and High Suffolk Claylands JCA) and possibly on the East Cost Main Line (Peterborough, Newark, York, Darlington).

3.44 To understand the nature of such change in the broader countryside and to appreciate the possibility of influencing it, it is instructive to investigate the differing role of new building and reorganization of the existing stock. The effect of the construction of new units is represented by the **Lucsrunits** grid. Abstracting from building within urban areas or at the margin of urban areas and generalizing to the 10km scale generates the grid **Rlucsrunit10k**) illustrated in Figure 3.14. On the basis of this grid, it appears that new building drives the increases in dwelling stock around the Bedfordshire and Cambridgeshire Claylands for example.

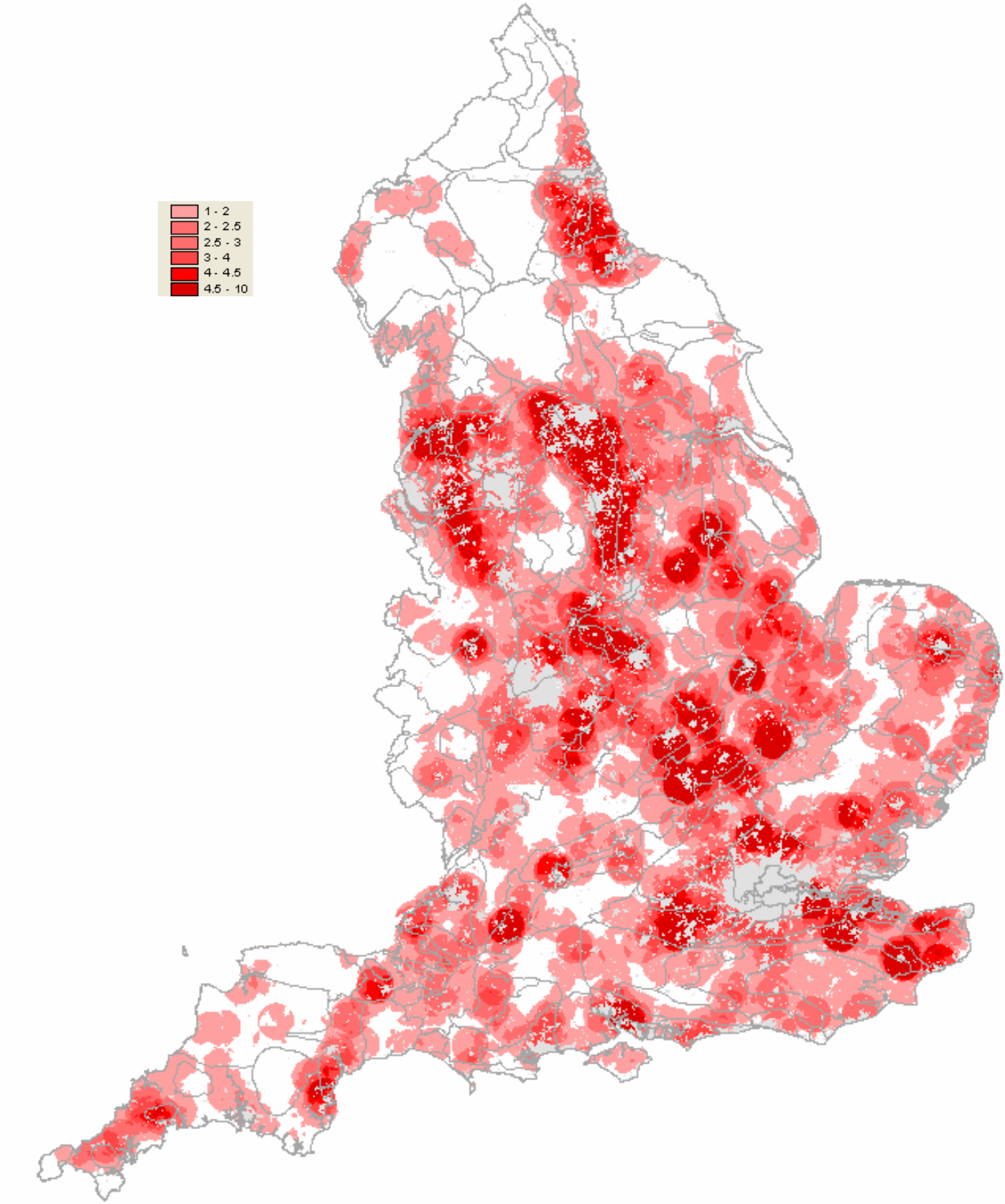
3.45 Conversion and reorganization of existing buildings substantially modify the effect of new build and are important devices for changing the number and nature of dwelling units within the rural domain. Most frequently, conversion of non-residential buildings (variously barns, shops etc) are assumed to augment the dwelling stock. Subdivision of farm buildings works in a similar way. Comparison of the **Rstocknetc10k** and **Rlucsrunit10k** grids (see Figure 3.15) suggests that conversions *combine* with new build to generate substantial increases around York (Vale of York JCA), and the Vale of Pickering. It also demonstrates that conversions *alone* may yield relatively significant gains, increasing anticipated trip generation even under restrictive local planning regimes. Thus intensification is achieved with very limited new building in the Adur Valley in West Sussex (Low Weald, South Downs and Wealden Greensand JCAs) and around Holmfirth and Honley (Yorkshire Southern Pennine Fringe).

Figure 3.13: Net Change in Dwellings in the Broader Countryside 1998-2003, 10km smoothing (units per square kilometre) (grid = **Rstocknetc10k**)



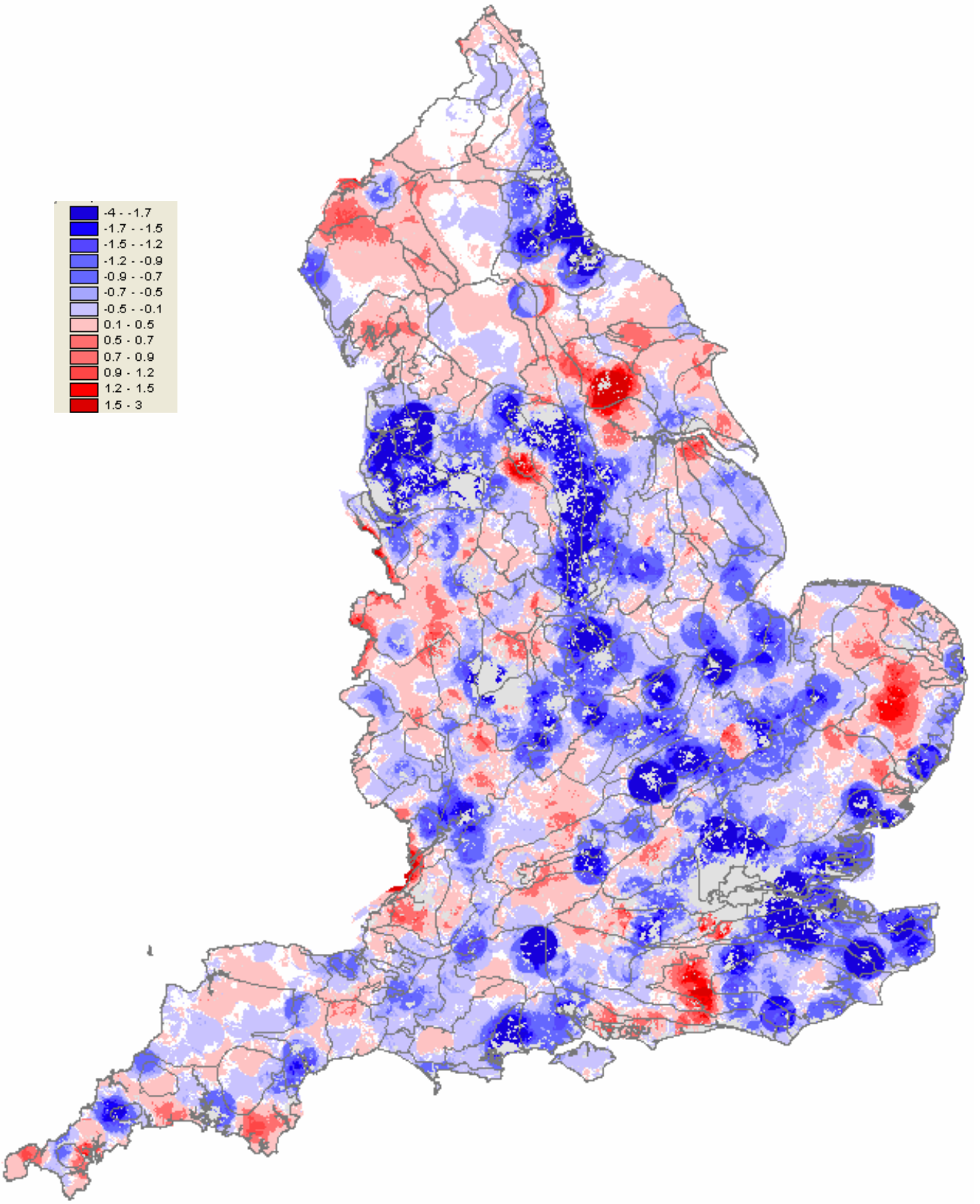
Rstocknetc10k indicates net change in the number of dwellings between 1998 and 2003 in each hectare tile (excluding urban areas with a population of 10,000 or more and land at the urban margin (see text)). Increasing intensities of red indicate increasing numbers of dwellings (whether due to new building, residential subdivision or conversion from other uses). Increasing intensities of blue show falls in numbers of dwellings which may result from amalgamation to form larger units, demolitions or changes of use. Values shown are averaged over a 10km radius and expressed as units per square km.

Figure 3.14: LUCS Residential Units Built in the Broader Countryside, smoothed by 10km (units per square kilometre) (grid = **Rlucsrunit10k**)



Rlucsrunit10k shows in increasing intensity of red the number of dwellings built between 1998 and 2003 in each hectare tile (excluding urban areas with a population of 10,000 or more and land at the urban margin (see text)). Values shown are averaged over a 10km radius and expressed as units per square km.

Figure 3.15: Change in Dwelling Stock not Attributable to New Building, smoothed by 10km (units per square kilometre) (grid = **Rconamadem10k**), see para 3.45 for explanation



Rconamadem10k indicates change in numbers of dwellings in each hectare tile (net of change due to new construction). Increasing intensity of red identifies gains through residential subdivision or conversion from non-residential use. Increasing intensity of blue show falls in numbers of dwellings which may result from amalgamation to form larger units, demolitions or changes of use. Values shown are averaged over a 10km radius and expressed as units per square. (Urban areas with a population of 10,000 and land at the urban margin are excluded (see text)).

3.46 Reorganization of existing buildings allows for flexibility in how units are presented to the market, contributing to meeting demands for accommodation of differing sizes. It is important to appreciate that the net effects of this flexibility are not clear a priori. Conversion may lead to intensification of use (implying more households), or disintensification where units are amalgamated. It should also be noted that demand for property of a particular size and character may lead to intensification or disintensification depending on the character of the existing stock. Modification of the existing stock may moderate the influence of new building. Thus in the rural area around Ashford (Wealden Greensand, North Downs and Low Weald JCAs) and Milton Keynes (Bedfordshire and Cambridgeshire Claylands), amalgamation of dwellings in the years 1998 to 2003 seems to have modified the mix of dwelling sizes brought to the market, while reducing the total scale of household growth. (This conclusion should, however, be treated cautiously as any tendency by OS or its contractors to underestimate the density and hence number of units on new developments could generate the same result). Elsewhere, (such as in the West Cost Main Line Corridor between Warrington and Lancaster) amalgamation of units seems to have almost totally offset rural household growth associated with this new build.

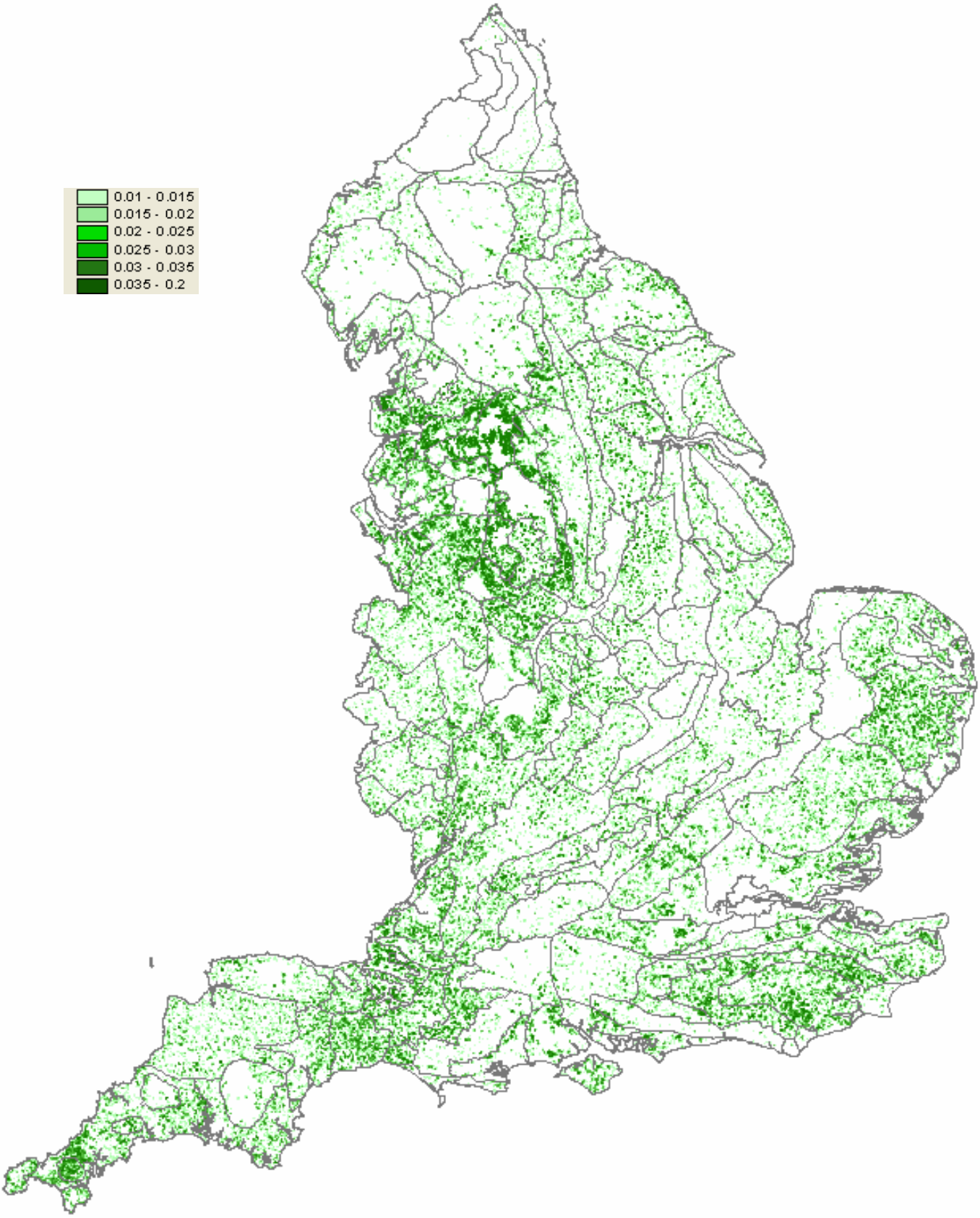
Additional Dwellings in Hamlets and Isolated Farmsteads

3.47 Relatively speaking, as indicated in Table 3.1, the rate of growth of households in hamlets and isolated farmsteads has been very high. To aid understanding of the nature of change in the very smallest settlements, it may be useful to review their definition. In work on rural and urban definitions for the Countryside Agency and its collaborators, an appeal was made to the notion of a 'farmstead'. Away from villages and larger settlements (identified using density profiles), farmsteads were identified on the basis of addresses -*as longstanding elements of the settlement hierarchy without presumption about any present role in the organization of agricultural activity*. Following this procedure, a farmstead may be directly signalled by an address such as 'X Farm', or indirectly by an address such as 'X Farm Cottage' or 'X Farm House.' However many ancillary properties there may be ('X Farm Barn etc'), a particular grouping is only taken to indicate one farmstead. Subsequently groups of three to eight farmsteads within 200 metres of each other were classified as 'hamlets.'

3.48 As part of the present project, these processes were repeated, first to identify 'farmsteads' at the end of 1998 and at the beginning of 2004 (Figure 3.16), and then to identify individual associated (residential) properties. The presumption that the set of farmsteads would remain almost static was confirmed. The number of farms in 99.9% of tiles remained unchanged, with 12,902 tiles (0.04%) showing losses and 22,181 (0.06%) showing gains (illustrated within Figure 3.17).

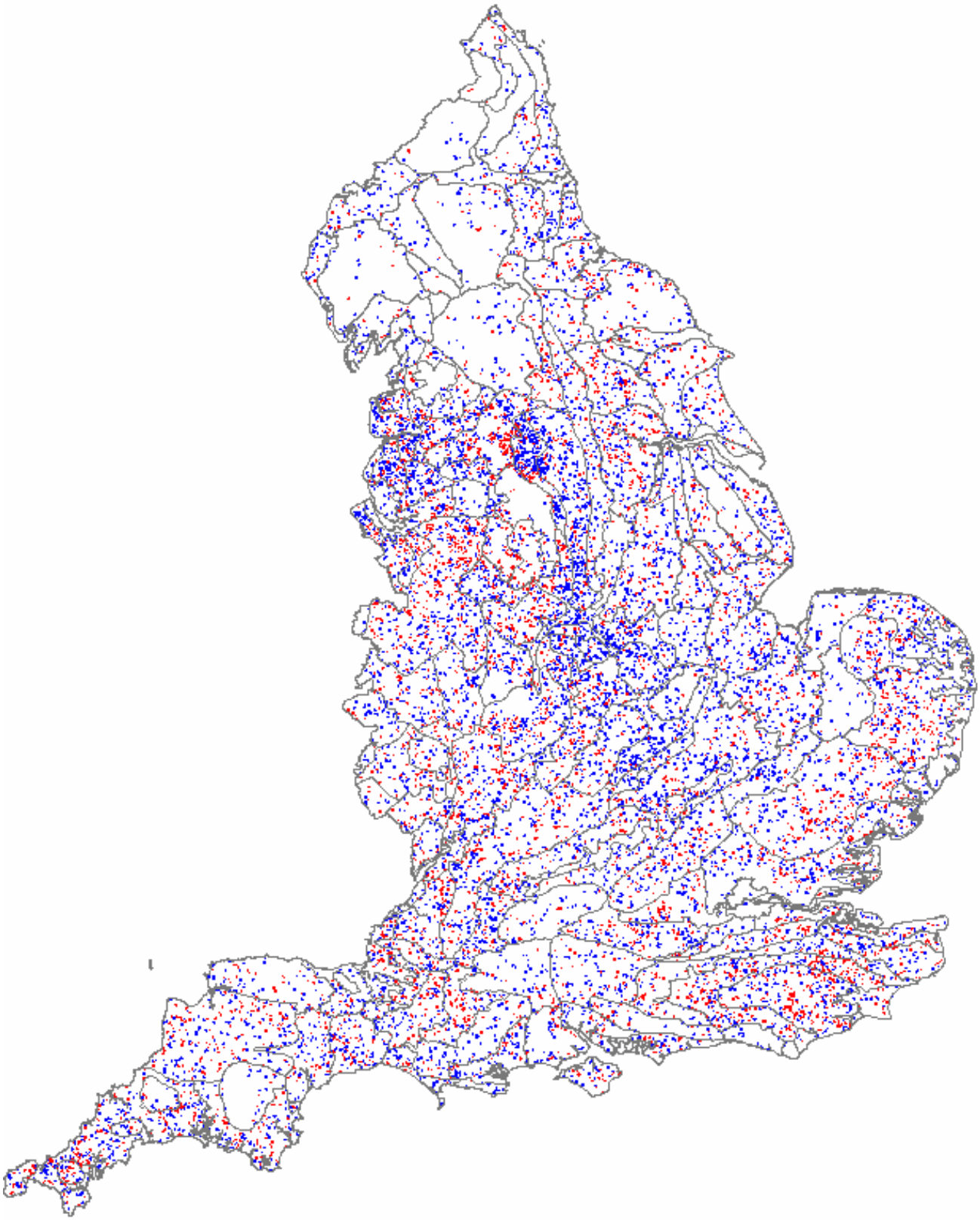
3.49 The geographic distribution of hamlets and isolated farmsteads revealed is dominated by the widely appreciated distinction between champion landscapes and wood-pasture landscapes, and the patterns of change mediated by the housing market have also to be understood in relation to historic settlement patterns. The western wood-pasture belt stretches through the South West peninsula, the Welsh marches and the West Midlands, the Peak and Pennines and the North of England. An Eastern wood-pasture belt embraces Sussex and Kent into Essex, Suffolk and the West of Norfolk. Between the two lies the champion belt of nucleated villages and fewer, larger farmsteads.

Figure 3.16: Farmsteads, 2003 (units per hectare) (grid = **Hfarm03_800m**)



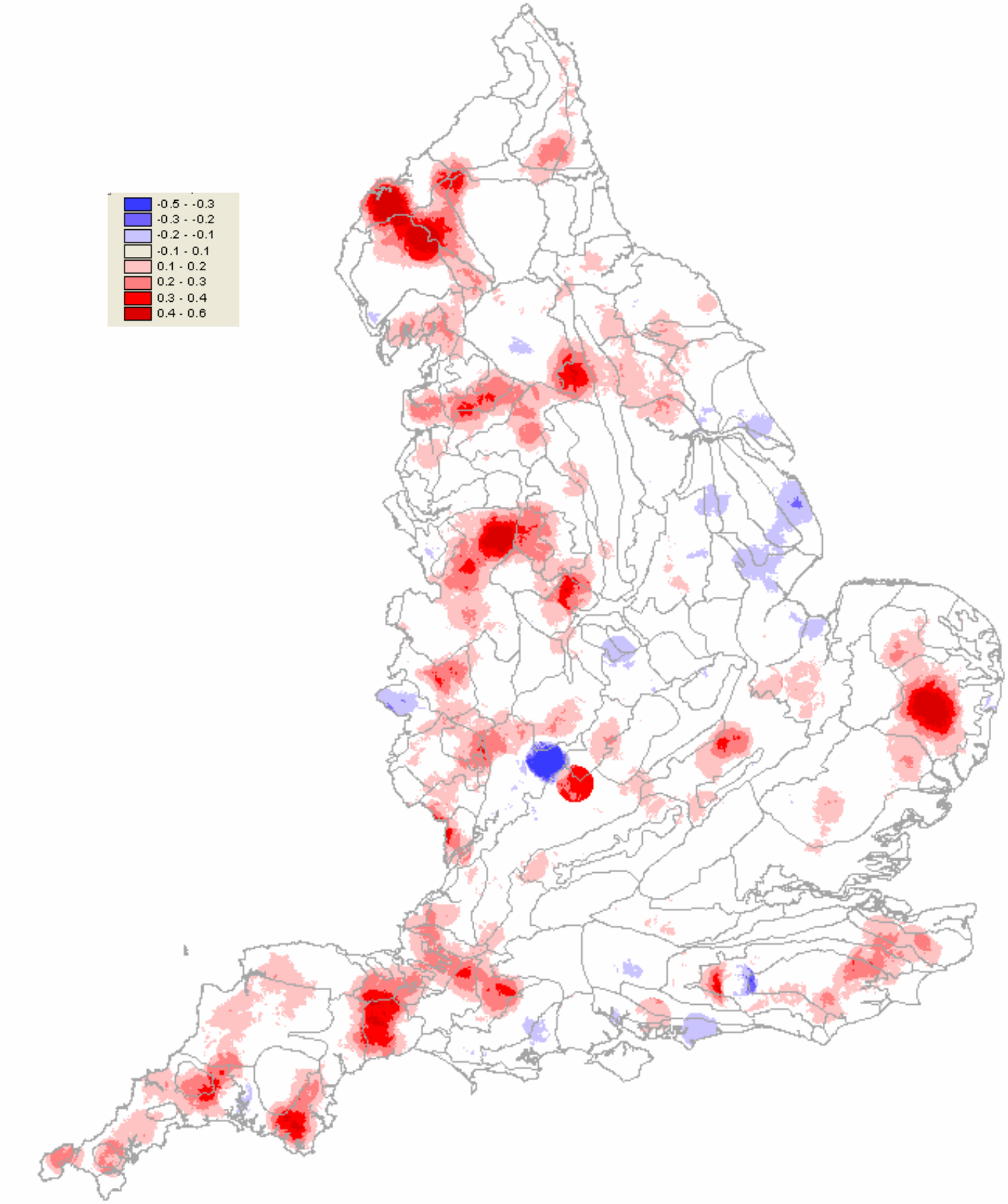
Hfarm03_800m indicates in increasing intensity of green the number of farmsteads per hectare. 'Farmsteads' here represent part of the inherited settlement pattern and do not refer to the current organization of agricultural production. Values shown are averaged over an 800m radius. (For further explanation, see text).

Figure 3.17: Change in Farmsteads, 1998-2003 (greater / less than 0.5 farms per square km)
(grid = **Hfarmch_800m**)



Hfarmch_800m indicates intensity of net change in the number of farmsteads per hectare between 1998 and 2003. 'Farmsteads' here represent part of the inherited settlement pattern and do not refer to the current organization of agricultural production. Increasing intensity of red identifies increasing numbers of units being dubbed 'Farm' (irrespective of current use). Increasing intensity of blue indicates reductions, through demolition, subdivision or more usually change of use (eg to garden centres). Values shown are averaged over an 800m radius.

Figure 3.18: Change in Dwellings in Hamlets and Isolated Farms 1998-2004, smoothed by 10km (units per square kilometre) (grid = **Rpafchhaif10k**)



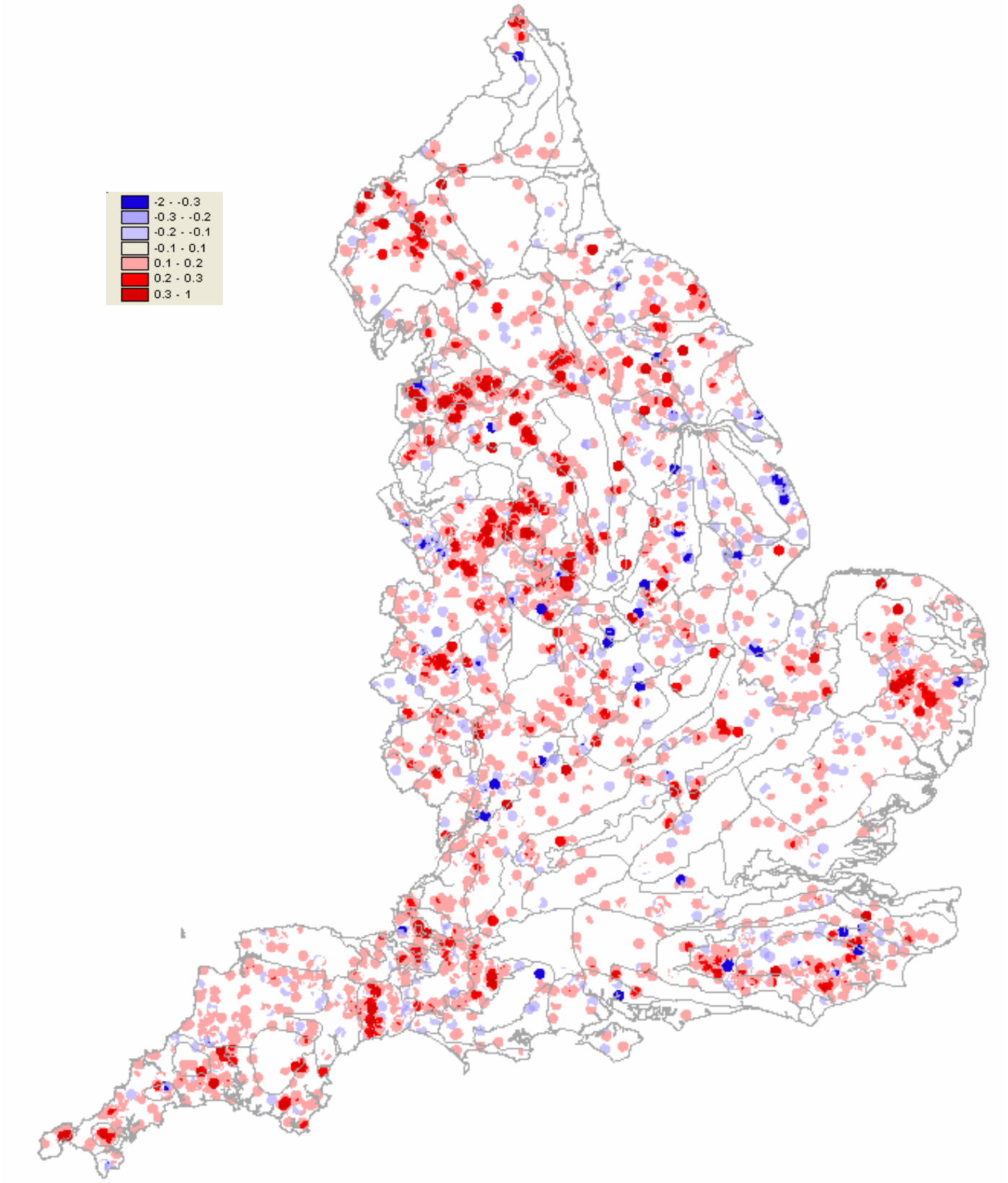
Rpafchhaif10k indicates net change in the number of dwellings in hamlets and isolated farmsteads between 1998 and 2003, Increasing intensities of red indicate increasing numbers of dwellings (whether due to new building, residential subdivision or conversion from other uses). Increasing intensities of blue show falls in numbers of dwellings which may result from amalgamation to form larger units, demolitions or changes of use. Values shown are averaged over a 10km radius and expressed in units per square kilometre.

3.50 Where areas historically characterized by dispersed settlement are relatively close to present concentrations of population, pressures to rural intensification are greatest. The limited change across the champion belt (see Figure 3.18) should be understood in this context. By contrast there was substantial growth in the smallest settlements in the years 1998 to 2003 across much of the western wood-pasture belt. In Cumbria (Solway Basin, Cumbria High Fells, and Eden Valley JCAs), and in Lancashire (specifically the Bowland Fringe and Pendle Hill JCA) marked and consistent increases are found. On the eastern fringe of the Pennines, similar tendencies are found. Marked increases in dwellings in hamlets are found to the south of the Manchester conurbation (Shropshire, Cheshire, and Staffordshire Plain, though not around Chester; South West Peak; and Needwood and South Derbyshire Claylands). Further south, in Shropshire and Herefordshire (counties typified by dispersed settlement), hamlets around the Shropshire Hills; Teme Valley; Herefordshire Plateau; Severn and Avon Vales; Malvern Hills and Herefordshire Lowlands seem to have accommodated significant growth. In the Blackdowns JCA around Honiton, Seaton and Sidmouth, growth of dwellings in hamlets was particularly marked (coinciding with some of the highest house prices in rural England at settlement level (see Bibby 2005)). Given the small size of these settlements it may be helpful to appreciate change by inspecting smoothed grids averaging out change in individual small settlements over a radius of 3 kilometres (see Figures 3.19 and 3.20 illustrating change within hamlets and isolated farms respectively).

3.51 Table 3.1 shows not only the very high rates of increase of dwellings in hamlets and isolated farms over the period, but also indicates that this has not depended primarily on new construction. In the smallest settlements, the number of units gained through conversion or reorganization of existing buildings appears to have exceeded the number of newly built units by a factor of four. It is possible that this effect derives in part from a systematic tendency for residential development in remote settlements to be recorded on LUCS only after longer lags (potentially leading to under-recording in the short term). More detailed analysis of address data, however, suggests that any such tendency is unlikely to be the principal cause.

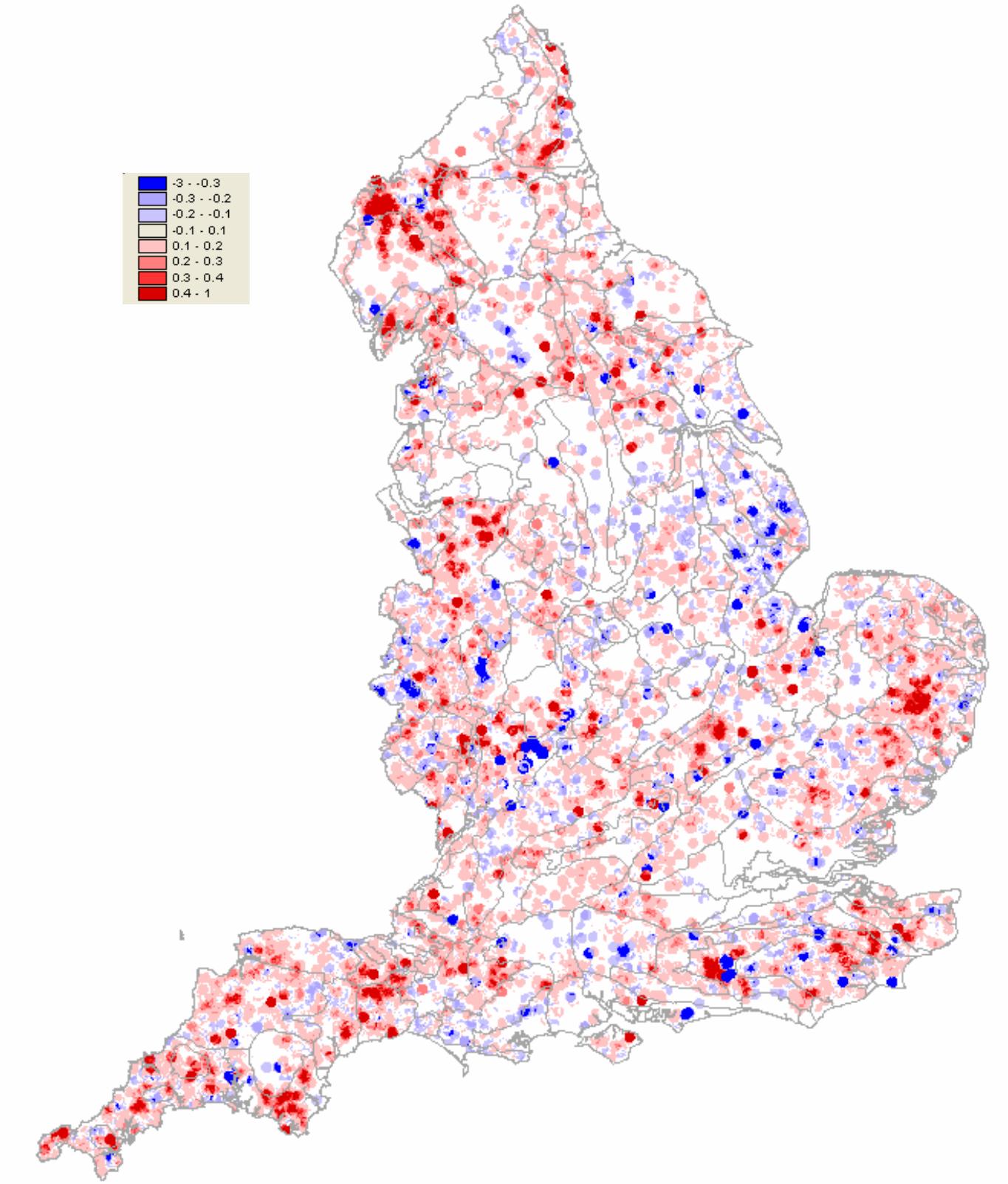
3.52 Recourse to the natural language evidence of the Post Code Address File provides strong direct evidence of the likely role of property conversion. This may be illustrated by considering the increases in property referred to as ‘X barn.’ (This includes terms such as ‘The Barn,’ ‘The Old Barn,’ ‘Highstones Head Barn’ but excludes terms such as ‘Common Barn Farm,’ ‘Barn Cottage’ or ‘Barn Again Bistro’). Restricting attention to such property in villages or on their fringes, in hamlets or adjoining isolated farms, it appears that there were 9988 such properties in 1998. They are represented on the **Barns98** grid and illustrated smoothed to three kilometres in Figure 3.21. Over the following five years, the numbers of such properties within the same settlement contexts (**Barns03** grid) had grown to 13,920, an increase of 39% (see illustrated Figure 3.22). Restricting attention solely to hamlets and isolated farms, the numbers of ‘barn’ properties increased from 3243 to 4935, or over 52%.

Figure 3.19: Change in Dwellings in Hamlets 1998-2003, smoothed by 3km (units per square kilometre) (grid = **Rpafchha3k**)



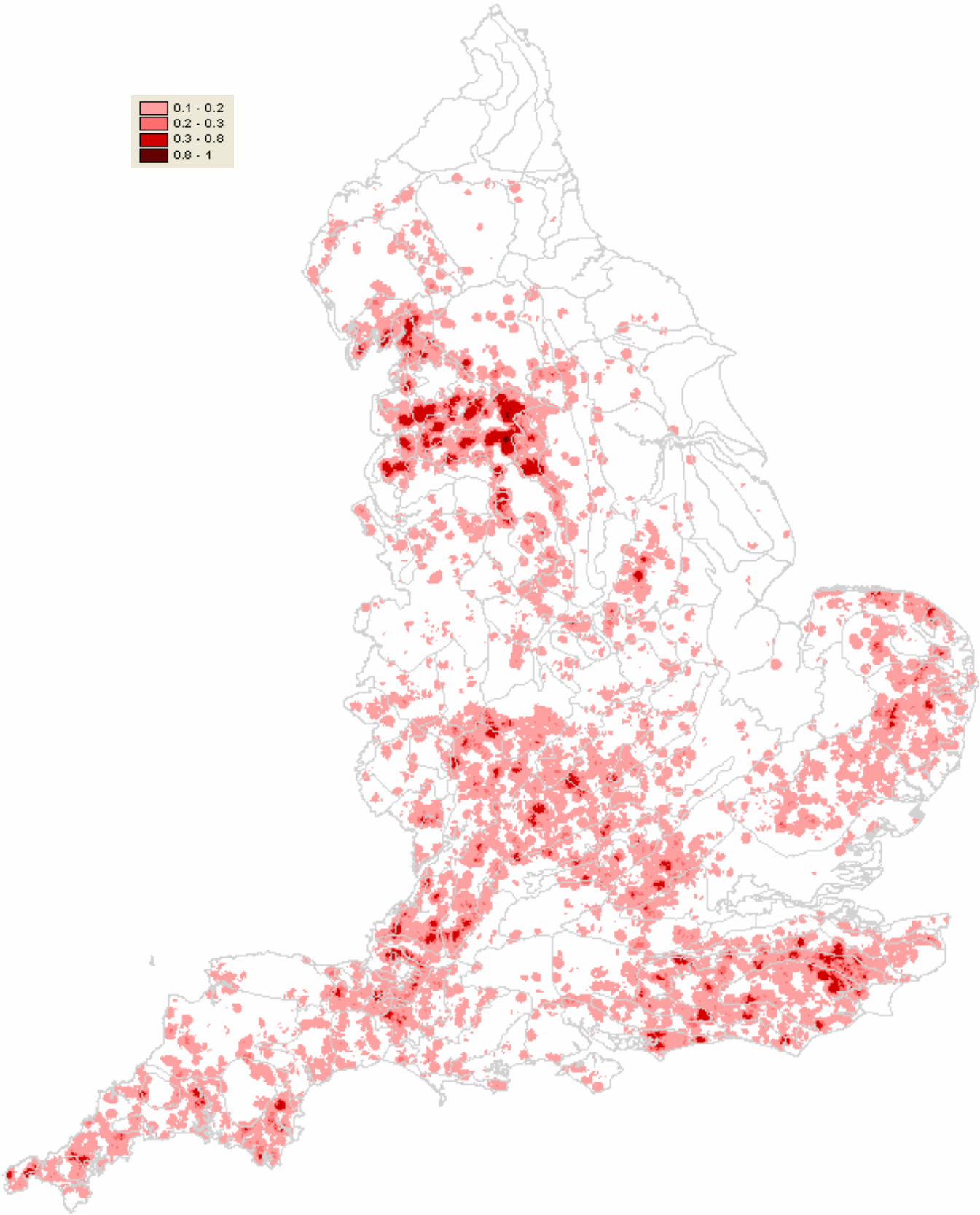
Rpafchha3k indicates net change in the number of dwellings in hamlets between 1998 and 2003
Increasing intensities of red indicate increasing numbers of dwellings (whether due to new building, residential subdivision or conversion from other uses). Increasing intensities of blue show falls in numbers of dwellings which may result from amalgamation to form larger units, demolitions or changes of use. Values shown are averaged over a 3km radius and expressed in units per square kilometre.

Figure 3.20: Change in Dwellings in Isolated Farmsteads 1998-2003, smoothed by 3km (units per square kilometre) (grid = **Rpafchif3k**)



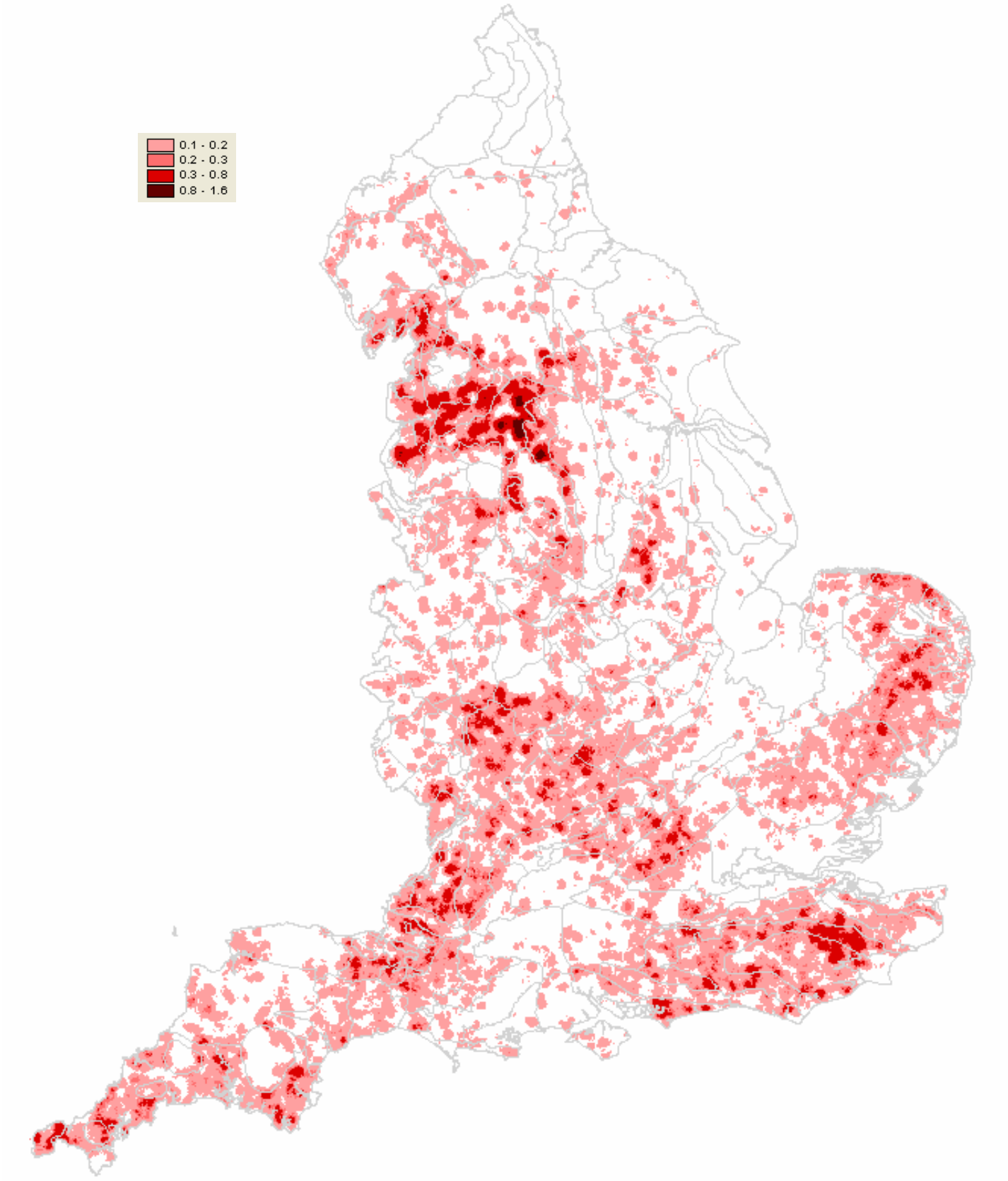
Rpafchif3k indicates net change in the number of dwellings in isolated farms between 1998 and 2003. Increasing intensities of red indicate increasing numbers of dwellings (whether due to new building, residential subdivision or conversion from other uses). Increasing intensities of blue show falls in numbers of dwellings which may result from amalgamation to form larger units, demolitions or changes of use. Values shown are averaged over a 3km radius and expressed in units per square kilometre.

Figure 3.21: 'Barn' Property 1998, smoothed by 3km (units per square kilometre) (grid = **Barns98_3k**)



Barns98_3k indicates in increasing intensity of red the number of residential properties per hectare dubbed 'X Barn' in 1998, Values shown are averaged over a 3km radius and expressed in units per square kilometre. (For further explanation, see text).

Figure 3.22: 'Barn' Property 2003, smoothed by 3km (units per square kilometre) (grid = **Barns03_3k**)



Barns03_3k indicates in increasing intensity of red the number of residential properties per hectare dubbed 'X Barn' in 2003, Values shown are averaged over a 3km radius and expressed in units per square kilometre. (For further explanation, see text).

3.53 There is quite a distinct geography to the residential use of 'barn' property. In 1998, it showed some relation to the traditional wood-pasture areas. The highest densities were found in the Pennines (South Pennines, and Yorkshire Southern Pennine Fringe JCAs, extending to the Morecambe Coast and Lune Estuary JCA), with coverage of the eastern wood-pasture belt. (It should be noted that some wood-pasture areas such as the Welsh Marches are not highlighted, while barn properties were also found where the London-Birmingham corridor crosses the champion belt). It appears that conversions in the ensuing five years tended to maintain this particular pattern of geographic differentiation, with some spreading (into Shropshire, for example).

3.54 Hopefully, the foregoing paragraphs serve both to illuminate some characteristics of settlement change in manner pertinent to the concerns of *Countryside Quality Counts* and also begin to tackle some recurrent issues in understanding the shifting function of rural localities. Crudely, it appears that planning policy is concentrating a substantial part of new development in urban areas and in checking growth at the urban margin, but there is evidence of diffuse development relatively close to the conurbations, which may be all too easily overlooked simply because it is widely dispersed. It appears that while the urban margin accommodated an extra 94,000 households in 5 years, an extra 171,000 were accommodated in the rest of the rural domain. This has to be understood in the context of a dynamic where controlling the geography of housebuilding is not the same as controlling the geography of settlement change. New construction has a complex relation to the nature of residential property being brought to the market, with a different mix of units being made available, and in different places.

3.55 Rather less formal housing options also impinge on the rural domain. With the recent increases in house prices, park-home living has become an option for an increasing proportion of those reaching retirement. Indeed the increase in park-home sites (facilities within PAF) is illustrated in Figure 3.23. In this section, it has been possible to illustrate in considerable detail the pattern of settlement change away from the margin of major urban areas, to hint at the extent of conversion activity, and hint also at some of the long-distance linkages underlying these patterns.

3.56 It is far more difficult, however, to suggest a response to these trends, whether in terms of countryside character or more generally. One reason is that it is always difficult to represent, visualize and debate diffuse development. Hopefully, the preceding section has shown that methods can be developed to use available data to mitigate this difficulty. Another is that much of this development is not obviously visually intrusive. It might easily be argued that the patterns of change within the broader countryside noted above are an index to, or a moment of, fundamental change in agricultural practices with serious implications for landscape. It would, however, be difficult to sustain an argument that changes in the use of existing buildings and associated parcels of land were anything but incidental to such fundamental change. What hopefully is clear is that there are data sources and there are methods that might be used to explore this creatively.

Figure 3.23: Numbers of Units at Park-Home Locations and New Unit Development 1998-2003 (grids = **Phomes_units** and **Phomes_nunits**)

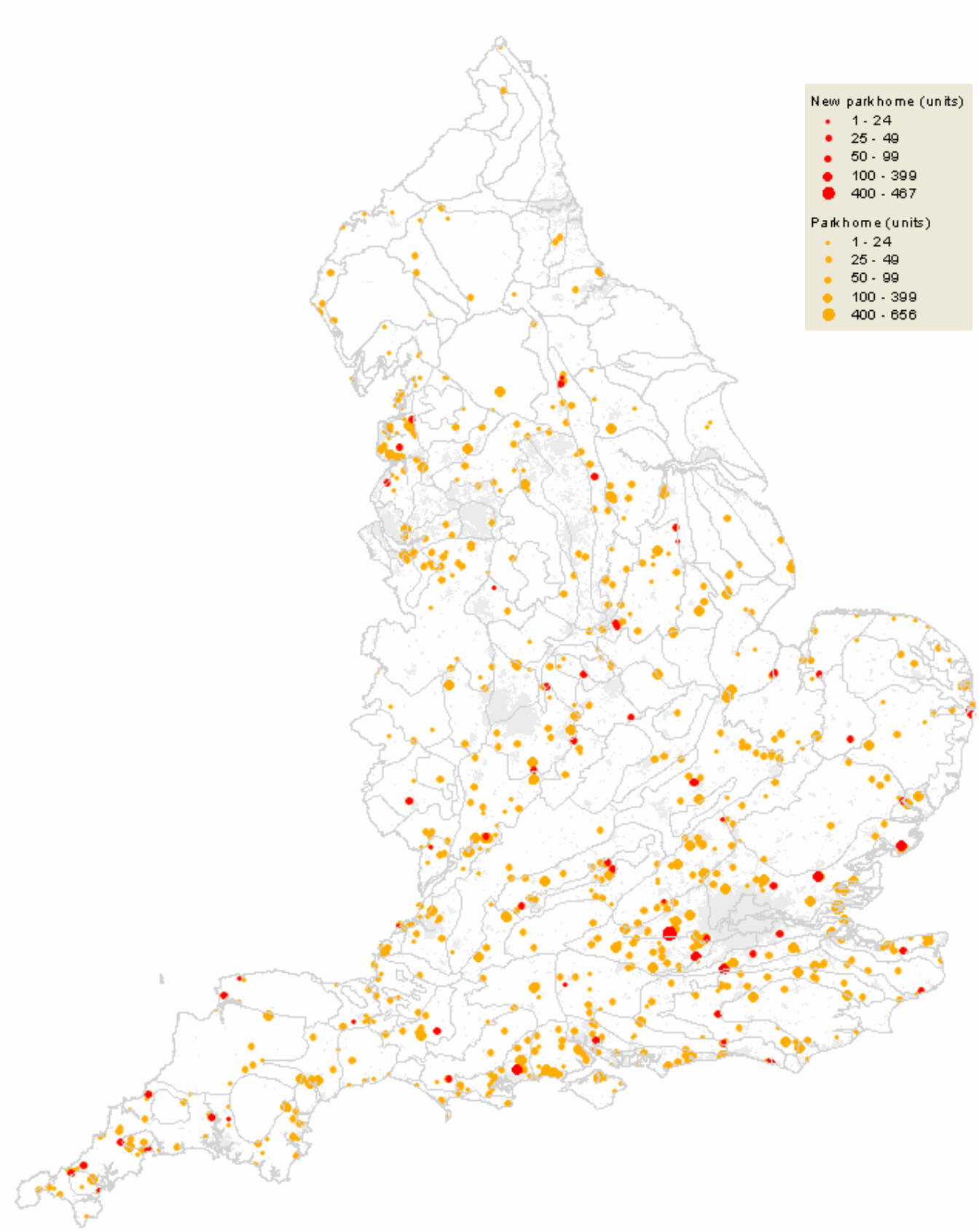


Figure 3.23 indicates with orange proportional symbols the number of units in 'Home Parks.' Red proportional symbols indicate the number of units in 'Home Parks' developed between 1998 and 2003.

4. Moving Forward: Integrating Datasets, Drawing Inferences, Characterizing Change

Overview

This section considers the possibility of developing ways of understanding change in settlement and development that characterize the types of locality that are disappearing and the types of locality that are emerging.

The approach developed uses the concept of a 'facility' –a space organized to facilitate a particular type of activity, characterized by particular patterns of behaviour, owned by or leased to single legal entity and subject to a single management. In Section 3, natural language processing methods and other techniques from artificial intelligence were used to infer the presence and extent of particular facilities. It proves extremely difficult to develop convincing descriptions or categories for objects *broader* than the facility.

In the work described here, the idea of characterizing broader areas was not taken further, Instead, this section considers the possibility of examining both the portfolio of facilities being created and the portfolio of facilities being lost. Extending the type of technique introduced in Section 3, it is potentially possible to move from consideration of particular instances of individual facilities such as dwellings, workshops, airfields or country houses to the JCA or national level. At the same time the sort of approach developed in Section 3 might be complemented by devoting more attention to units of development and bringing together economic and historical approaches. A range of data can be brought together, reducing the gap between macroscopic and microscopic analyses and forming the basis for considering possible future landscapes.

The first step in the type of approach outlined would start be examination of the supply of land for particular uses, but paying specific regard to a pre-existing mosaic of facilities inferred from PAF. Second, tendencies underlying supply conditions would be identified, potentially prompting the release of these facilities to other uses. The third step would be to examine the extent to which these facilities come to be recognized within the planning system as land available for particular forms of development (evident in NLUD PDL and LDFs). In the fourth and final step, former facilities may become *units of development* and new facilities are created. The nature of these new facilities might be inferred using LUCS and PAF (together other sources).

This section attempts to show that this type of approach might prove useful in working through the implications for the countryside of de-industrialisation, de-militarization, shifting approaches to health and social care and changes in the organization of electricity generation.

4. Moving Forward: Integrating Datasets, Drawing Inferences, Characterizing Change

4.1 A recurrent theme in discussing countryside quality and character is the search for effective ways of typifying the sorts of locale being lost and sorts of locale that are emerging. Such characterizations would potentially enrich accounts of changes in the aggregate area of land subject to particular uses, enabling a fuller understanding of the implications of development for landscape. Informally, we may be familiar with a particular former industrial area now redeveloped as sheds for retail and leisure uses. There might seem to be some value in formalizing a lexicon, or more fundamentally, an ontology of locales to assist in describing such changes and quantifying their extent. It would also be desirable that any such ontology could locate types of locale (and possibly patterns of change) within some broader conceptual framework. This section is concerned with ways of pursuing these goals.

Characterizing Changing Areas: A Linguistic Approach

4.2 In the absence of a clearly theorized set of areal categories, the task was initially approached through consideration of language in use, attempting to explore the question by considering the types of locale that are referred to in addresses and geographic descriptions in sources such as PAF and NLUD PDL. The linguistic approach complements that of Section 3, which was used very successfully to bring together intelligence about land use change (from LUCS) and textual descriptors to identify units of development such as distribution parks. When this approach is applied to broader geographic scales, however, it is quickly found to have severe limits. In this section, therefore, a linguistic approach is supplemented by convergent economistic and historical perspectives.

4.3 It is important to understand the nature of the linguistic approach, and the root of its limitations. The linguistic approach rests on agreement about the existence of particular types of object, implying both consensus about classification and underlying material order. The *textual* organization of addresses is able to encapsulate aspects of the *material* organization of the surface of the earth. It seems obvious that there is a relation between the textual entries on PAF and units of land brought forward for development, but in a computational context this relation and its limits must be made explicit. Work undertaken here shows the strength of consensus over what are termed here ‘facilities’ such as restaurants, hospitals, or garden centres. Facilities are most frequently represented by individual addresses (eg ‘The Oak House,’ ‘43’, ‘Duchy Hotel’ or ‘Providence Mill’).

4.4 It may be useful to clarify the import of the term ‘facility’ as it is central to the computational inferencing on which this report depends. It is used here to denote a space organized to facilitate a particular type of activity, characterized by particular patterns of behaviour, owned by or leased to single legal entity and subject to a single management. Facilities might be regarded as the durable, physical shells of what Barker (1968) termed milieu-behaviour synomorphs. (For Barker, the regular 11 o’clock Sunday communion service at St Mary’s church is a milieu-behaviour synomorph: the approach adopted in this report treats the church building as the corresponding facility). Facilities (such as dwellings) may comprise other facilities

(such as bathrooms), and must provide their synomorphs with what Barker terms a circumjacent boundary. As stylized spaces and patterns of behaviour are deeply embedded in social life, an ontology of facilities can be readily constructed and the existence of facilities can usually be inferred computationally from postal addresses.

4.5 Difficulties arise with the linguistic approach because of the paucity of generic terms referring to a spatial scale *broader than that of the individual facility*. There is little agreement about terms for broader areas or zones. The starting point for an investigation of the range of generic terms for broader areas is the set of postal addresses within PAF. The structure of PAF includes the textual fields 'dependent thoroughfare', 'thoroughfare,' 'double dependent locality', and 'dependent locality.' By way of shorthand the first two are here referred to together as the 'thoroughfare fields' and the second two as the 'locality fields'. Previously, it has been pointed out that particular types of object such as an industrial estate might be treated as a 'locality' or a 'thoroughfare' by Royal Mail and thus for some purposes, texts drawn variously from thoroughfares, localities, premises and occupier fields are considered together as referring to 'features'.

4.6 The immediate analytic goal is to identify categories of 'feature,' particularly those referring to areas larger than the individual facility. Some of these will be indexed by a thoroughfare field within PAF. A textual 'thoroughfare' of course, refers most frequently to a highway providing access to a series of plots indexed by one or more addresses. In the simplest cases where the pattern of development accords with the 'street and plot' model, there is a close homology between the units of land at first development (as characterized by the urban morphologists) and the textual pointers. In such cases, a street name indexes an area broader than an individual facility.

4.7 It may be helpful to consider just what might be inferred from a street name. Street names tend to have a polysemous quality so that 'Sara Close,' for example, might be taken to refer either to a thoroughfare or to the properties to which it affords access. (This might be thought of as figure-ground polysemy). In some cases, 'figure' and 'ground' seem reversed and polysemy is even more obvious. (Consider whether a term such as 'Victoria Terrace' refers to a row of houses or to the associated thoroughfare). Generally, therefore, a street name might be thought of as indicating either or both means of access *and* the parcels accessed. Moreover, it might be considered to index the aggregate of all the plots accessed. This last indexed area will be referred to here as the 'street-parcel'. A street-parcel is an area which is clearly not a facility, but broader than a facility. It is, however, a *unit of development* and its boundary may follow that of a former facility. (Historical geographers have pointed out for many years that what are here termed street-parcels frequently correspond to prior agricultural enclosures).

4.8 Where the pattern of development does not accord with the street and plot model, the text in the PAF 'thoroughfare' fields will not refer to a highway or a street-parcel. Most commonly in these cases it is possible to infer the presence of a facility- a material object (such as an industrial estate) -from a textual one such as 'industrial estate'). On the definition above an object such as a country house complex, a farm, or a retail park might all be considered as facilities (albeit that they comprise other facilities). In these cases too, it is possible to treat the text as denoting a unit of development (ie one or more land parcels, developed at the same time).

4.9 The term ‘park’ is particularly common within the ‘thoroughfare’ fields in PAF and frequently denotes development that does not fit the street and plot model. Usually preceded by a qualifier, it refers to a broad range of facility classes unified by the property of enclosure. Indeed, one sense of the term within the Oxford English Dictionary is ‘any enclosed piece of ground’ although its earliest (legal) sense refers to an enclosed tract of land reserved for hunting game. This property of enclosure underscores their status as facilities and units of development.

4.10 It is difficult to identify terms that refer to areas greater in extent than single facilities with the exception of street-parcels. Lexical analyses of the locality fields of PAF and the address fields of the NLUD PDL database led to the identification of 437 categories of ‘space’ additional to those in the original ontology (including ‘agricultural park’, ‘air park’, and ‘aviation park’; ‘business village’, ‘educational campus’, and ‘business campus’; ‘employment park’, ‘shopping mall’ and ‘oil terminal’). The majority of these (234 or 60%) were, however, at the lower level facility scale (‘outlet’ rather than ‘outlet village’). Investigation of the terms used in the thoroughfare and locality fields suggest that beyond this scale, the lexicon is very limited. (Examination of the NMR Thesaurus produced similar results). There are terms for settlements (village, hamlet etc), and some for parts of settlements (suburb), but frequently areal objects are (in the terminology of Saaed 1997) not lexicalized . There are instead compound terms- most frequently ‘area’ - preceded by all manner of qualifiers (eg ‘industrial area’, or ‘redevelopment area’).

4.11 To the extent that terms for broader areas are found in the sources examined, they tend to occur in the NLUD PDL database rather than in postal addresses. Examination of this source revealed a larger number of (compound) terms referring to ‘spaces’ broader than a facility (such as ‘neighbourhood centre’, ‘town centre’, and ‘urban village’). Even here, however, only 69 distinct terms referred to areas definitely broader than a facility. Descriptions of broader areas tend to be those of the commentator or bureaucrat (such as by local authority planners), rather than of the operator and may include aspirational expressions such as ‘opportunity area’. Lack of lexicalization at this scale might be seen as reflecting a lack of standardization in organizing space, with only weak control being exercised over broader areas.

4.12 One reaction to the absence of stable broader-scale terms might be to adopt some entirely empirical-statistical-classifactory approach (eg multidimensional clustering) to examining combinations of areas of land changing use. It might be argued, however, that the very absence of stable broader categories either in everyday use or in academic writing serves as a warning that a search for them might be misguided. Another response might be to shift-scale (initially at least) recognizing the importance of (higher-level) facilities and street-parcels and to focus attention here. The feasibility of this approach in relation to locales that are being created was demonstrated in Section Three (where urban expansion was treated through consideration of new residential enclaves (sets of new street-parcels) and of non-residential ‘parks’).

Landscape Change, Facilities and Development Units: A More Fine Grained Approach

4.13 The remainder of this section therefore explores whether an approach based on facilities might be usefully extended, to consider not only facilities being created, but also those being lost and to deepen understanding of the underlying processes. This would entail deploying not only an ontology of facilities, but devoting more attention to units of development and bringing together economistic and historical approaches. The following paragraphs provide some sketches of how the type of work undertaken as part of the *Countryside Quality Counts* initiative might be extended, and particularly the type of approach used in Section 3 of this report might be further developed.

4.14 Conceptually it seems appropriate to start with the supply of land for particular uses, but to understand this in relation to a pre-existing mosaic of facilities. Aspirations of landowners with respect to particular facilities are framed in an awareness of structural factors prompting the cessation of existing uses and stimulating the identification of potential development sites. For any particular price it is possible in principle to conceive of an (invisible) mosaic comprising *units of supply*. Some may crystallize as a portfolio of *units of available land* through the mediation of the planning system (visible through NLUD and LDFs). These may transmute into *units of development* if the market clears, the configuration of these last units (visible through LUCS) depending in part on the configuration of former facilities. This in turn produces a mosaic of facilities that may be inferred from PAF and basic-scale mapping.

4.15 The description above pays far more attention to historical specifics and to the detail of planning intervention than would a conventional economistic account. Such an account might typically restrict its concerns to the quantity of agricultural land at the urban fringe being brought forward for residential development without consideration of prior facilities or emergent development units. The expression ‘development unit’ or ‘unit of development’ is intended here to denote one or more parcels of land *actually* developed (or redeveloped) at a particular time. They correspond to town plan elements within urban morphology and introduce dependencies between past and present.

4.16 This portfolio of *units of available land* is far firmer than notional mosaics of units of supply. The NLUD PDL represents a large portion of this portfolio of available land. Any tendency to inertia in the settlement pattern and in the configuration of enclosures is reinforced by a planning system which encourages the re-use of previously developed sites. While the development of agricultural land might not be generally favoured, development of sites in rural areas which might be deemed previously developed (such as rural industrial sites, former airfields, or sites associated with coal mining and so on) may well be supported. The effect of these policy presumptions is that settlement change proceeds not simply by accretion at the urban fringe, but rather through locating new uses and facilities on a portfolio of existing developed sites This should be expected to have significant implications for understanding patterns of landscape change.

4.17 The NLUD PDL database is valuable in that it captures something both of previous use and current aspirations.. The categories used to describe previous use are a little chaotic:

airports

car parks
derelict land and buildings
docks
educational buildings
indoor recreation
industry
institutional and communal accommodation
institutional buildings
landfill waste disposal
mineral workings and quarries
no class defined below this division
offices
previously developed land which is now vacant
railways
religious buildings
residential
retailing
roads
storage and warehousing
utilities
vacant buildings

4.18 In summary, therefore, monitoring change in settlement and development may proceed in four steps. First, a prior set of facilities can be inferred from PAF. Second, a series of tendencies underlying supply conditions can be identified. Third, a large part of the institutionalized representation of land availability may be made visible using NLUD PDL. Finally a resultant set of development units and facilities may be inferred using LUCS and PAF (together other sources). The remainder of this section attempts to suggest how this framework might be made operational by providing a sketch of flows of sites being brought forward for development by reference to a few examples of particular uses. It attempts to show how a range of data can be brought together, reducing the gap between macroscopic and microscopic analyses. It cannot be too strongly emphasized, however, that the remainder of this section only suggests possibilities. The constraints of the present project allow nothing more than superficial glances at the forces underlying land supply, and the illustrations of particular types of change are merely preliminary.

Flows out of Agriculture

4.19 It would be inappropriate not to make any reference to flows out of agriculture, though only a very incomplete discussion is offered here. It is in regard to the supply of agricultural land for development where an avowedly economistic perspective seems most appropriate. Given the long-term trends evident both in agricultural output and agricultural employment, all accessible agricultural land might be regarded as potentially adding to a supply mosaic. Differentials between agricultural and residential land values send clear signals to land owners. It is clear moreover that while there is a close relation between urban structure and the amount of land brought forward for development, there is no relation between the amount of available greenfield land and the amount of such land that is developed. Development on previously agricultural land must be understood in relation to price rather than availability (Bibby, forthcoming).

4.20 Given the appropriateness of an economistic perspective on this sector, relatively little emphasis need be devoted to the factors driving the flows of particular agricultural

facilities. This is simply to reiterate that landowners may wish to offer any accessible agricultural land as part of the development land supply. From a landscape perspective, of course, the key issue is not what motivates attempts to bring land forward for development, but the intrinsic character and quality of the tracts potentially released. This is a matter for examination elsewhere within the Countryside Quality Counts initiative. For present purposes it will be sufficient to note the difficulty of bringing LUCS data to bear on these matters. Figure 4.1 shows that there is within LUCS an awkward blend of substantive effects (such as agricultural land conversion around the new settlement of Camborne in Cambridgeshire) and procedural artefacts (such as the absence of change around Tenbury Wells in Worcestershire arising from an absence of sweep survey activity). The key point here is that in the case of flows out of agriculture, a substantial body of analytic work (beyond the scope of the present report) would be required to operationalize the approaches summarized in para 4.18 above and that the return to this effort might be slight

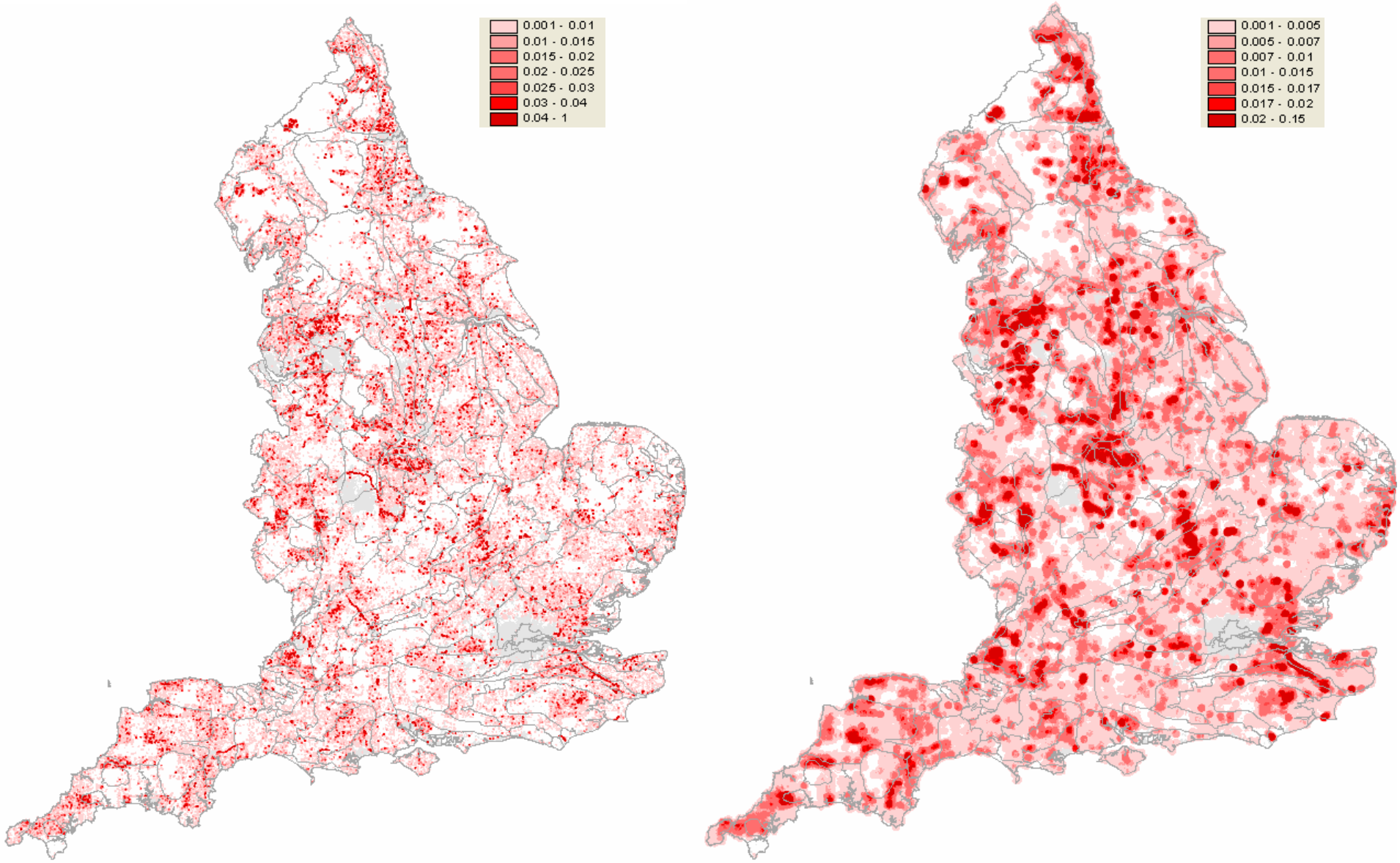
Flows out of Industry

4.21 The options open to agricultural land owners are far from being the only matters shaping land supply mosaics. With de-industrialisation, de-militarization, shifting approaches of health and social care and changes in the organization of electricity generation come patterns of development land supply which are far more appropriately treated by using the framework introduced above. Although idealized images of the countryside tend to overlook the presence of these sectors, in the very nature of their extensive character they are largely accommodated within the rural domain.

4.22 It is well understood that the release of industrial facilities within the cities provides an important flow of development land, particularly for residential purposes. Many of the most extensive industrial facilities (such as petrochemicals plants), however, are found at the urban margin where redevelopment may have a major impact on the countryside. While it would be possible to analyse forces that might prompt the cessation of particular uses and increase the flow of facilities which owners might wish to supply, it will be sufficient to examine the portfolio of available former industrial sites. (Recall that availability in the framework summarized in para 4.18 refers to status conferred through the planning system rather than the more intangible underlying notion of supply). A large part of this portfolio is represented within NLUD-PDL and its geographic distribution as of 2004 is illustrated in Figure 4.2 a and b.

4.23 The image of available previously industrial land in the rural domain provided by Figure 4.2 perhaps understates the implications for landscape change. Viewed at a national scale this graphic fails to capture differential site sizes and so overstates the importance of small sites in the cities. Examination of the NLUD PDL database also shows that former industrial sites in the rural domain or at the urban fringe appear more likely to retain their employment land designation than sites within the urban area (which are increasingly reallocated for housing). This is evident in Figure 4.2d which shows the scale of sites treated as available for employment use and allows the extent of land available at (former) chemical and petro-chemical installations at Carrington and Ellesmere Port to be compared with the scale of brownfield employment land provision in the core cities of Manchester and Liverpool.

Figure 4.1: Flows of Land from Agricultural Use, Source: LUCS, 1998-2003 (grid = **Lucsdevag**)

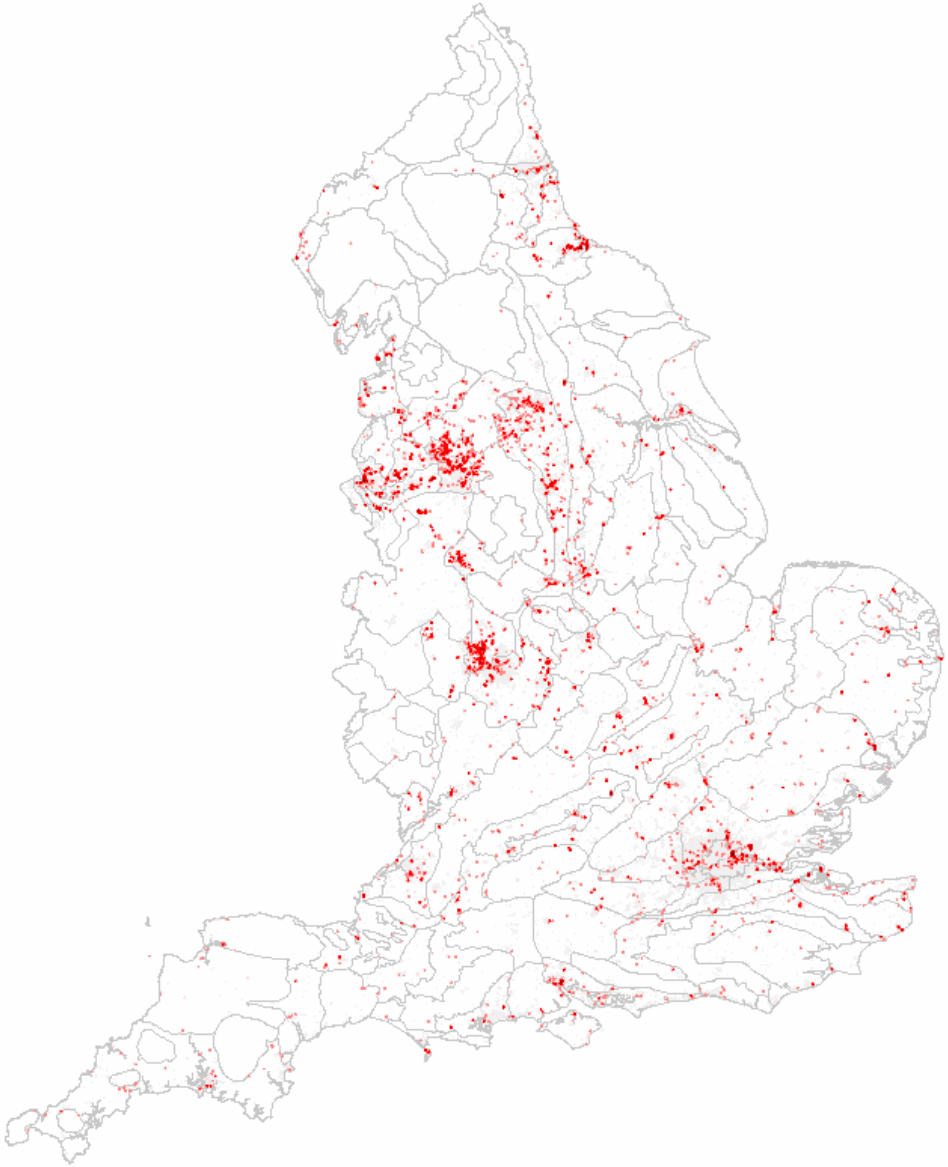


a) Smoothed at 800 metre scale

b) Smoothed at 3 kilometre scale

Figure 4.1a shows in increasing intensity of red the loss of land from agricultural use between 1998 and 2003 as a proportion of each hectare tile. Values shown are averaged over an 800m radius. Figure 4.1b shows similar information averaged over a 3km radius.

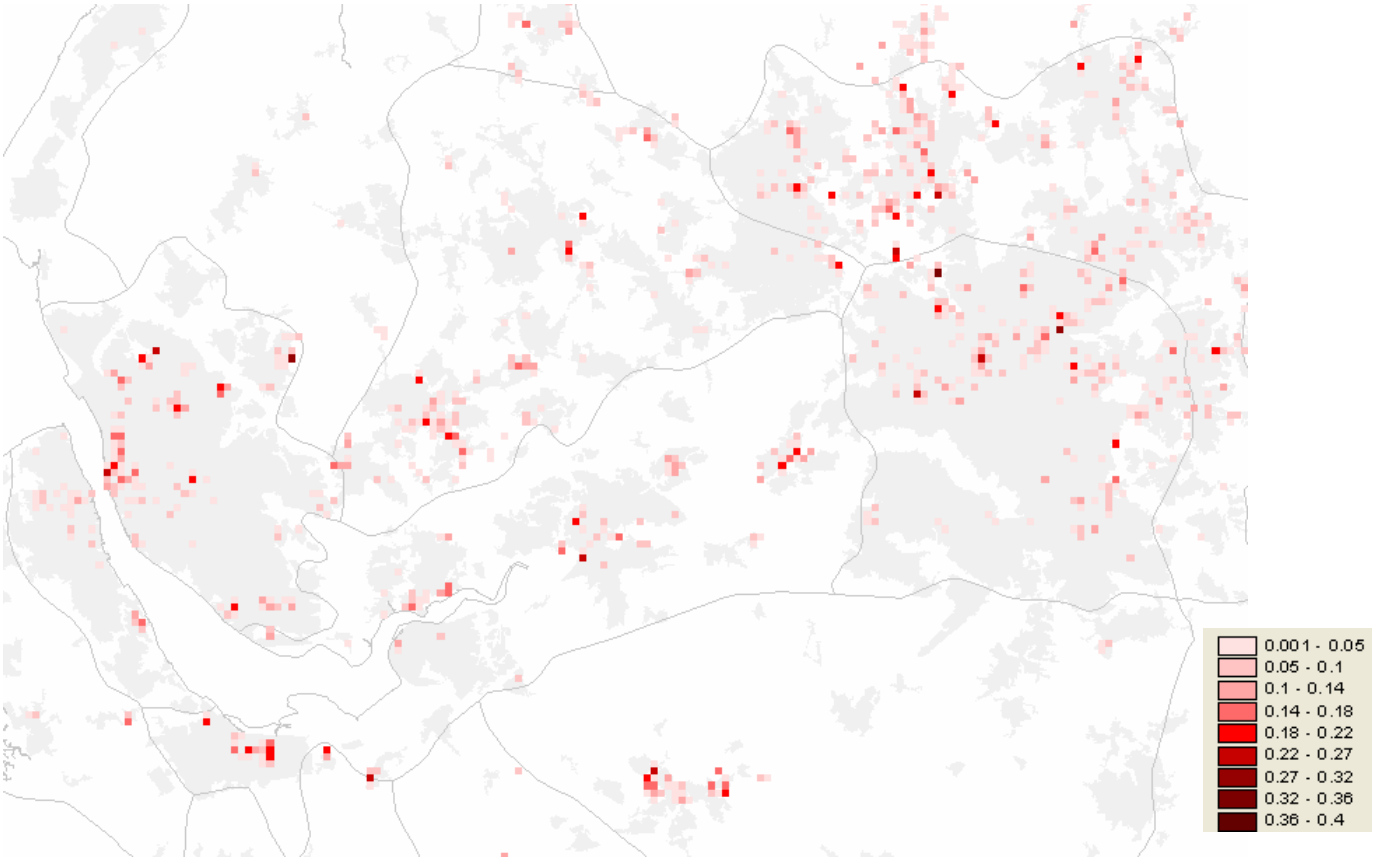
Figure 4.2: Extent of Previously Industrial Land Available for Redevelopment (NLUD-PDL 2004) (grid = **Industry**)



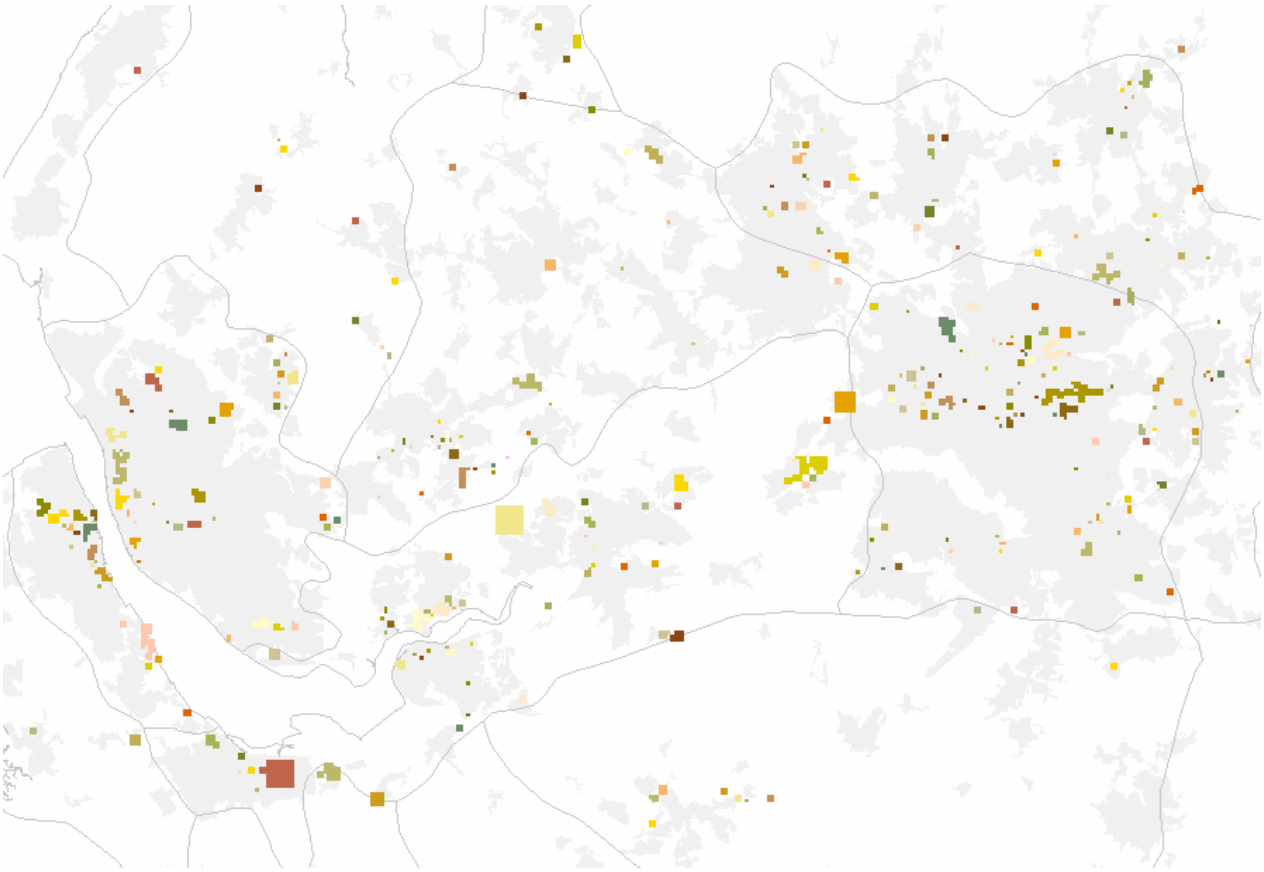
a) Locations within England

b) Locations within English rural domain only

Figure 4.2a shows in increasing intensity of red the stock of available brownfield land previously in industrial use as a proportion of each hectare tile (as of 2004). Figure 4.2b shows similar information, but excludes urban areas with a population of 10,000 or more.



c) Inset for Liverpool and Greater Manchester (depicting site size, hectares)



d) Inset for Liverpool and Greater Manchester (depicting contiguous cells of land designated available for employment) (gird = **Industry4em**)

Flows out of Defence Uses

4.24 Military installations constitute some of the most extensive facilities in the rural domain. The ending of the Cold War brought with it possibilities for increasing the supply of sites for development and ultimately concomitant landscape change. This process is now well advanced, though MOD estates policy continues to seek new uses generating a flow of sites, widely dispersed across the rural domain

4.25 For the purposes of the present project, barracks, airfields and military camps were treated as classes of facilities, identified as 'features' within PAF. They were also matched against the portfolio of available sites within NLUD PDL for 2004. (where there previous use is described as 'no class defined below this division'). Defence installations constitute the largest sites within NLUD. Taking these sources together it is possible to chart the current location of military facilities, to capture the extent and configuration of land available for development which they provide, and also to consider the new facilities that have taken their place. Thus Figure 4.3 illustrates the current geography of military facilities, also highlighting sites that have been re-developed as non-military facilities, and some of those which presently seem poised for change. Figure 4.4 (constructed in the same manner as the LUCS grids discussed in Section 2) draws attention to the extent of former defence land treated within the planning system as previously developed and hence potentially favoured for development.

Flows out of Utilities

4.26 Utilities form a further class of facility which are extensive in nature and thus frequently found within the rural domain. Power stations represent a particular important sub-class of utilities. For the purposes of the present project major power stations were identified from www.dti.gov.uk/energy/inform/energy_stats/electricity/dukes05_5_11.xls, and matched with facilities referenced by PAF for the second quarter of 2004. They were also matched against the portfolio of available sites within NLUD-PDL for 2004. The larger units of available land include sites along the Trent at Willington, Drakelow and Rugely, those beside the Mersey at Ince and Carrington, and Richborough where the Stour empties into the English Channel (Within NLUD-PDL they appear within the utilities category). The **Powerstations** grid has been constructed to represent key sites and is illustrated in Figure 4.5. Some of the larger sites are listed in Table 4.1 which shows their current extent. Figure 4.6 illustrates the area of land available for development previously in any utility use as shown on NLUD-PDL for 2004.

4.27 The circumstances of the operation of power stations are particularly complex, producing considerable uncertainty. The years with which this study is concerned saw substantial acquisition and transfer activity amongst electricity producers, and a reported fall in the price of wholesale electricity of around 40 per cent, triggering exits of firms from the market. Moreover, while national policy involves seeking new sources of electricity generation (including possibly a new generation of nuclear plants), there is excess capacity in power-generation in the short term. This has led to mothballing of stations (such as Ironbridge, the Isle of Grain and Killinghome at the end of 2003). The situation in Killingholme in the Humber Estuary JCA is particularly notable as uncertainty about the future is found in an area subject to substantial physical development in the period between 1998 and 2003.

Figure 4.3: Current Geography of Military Facilities (grid = **Militaryfac**)

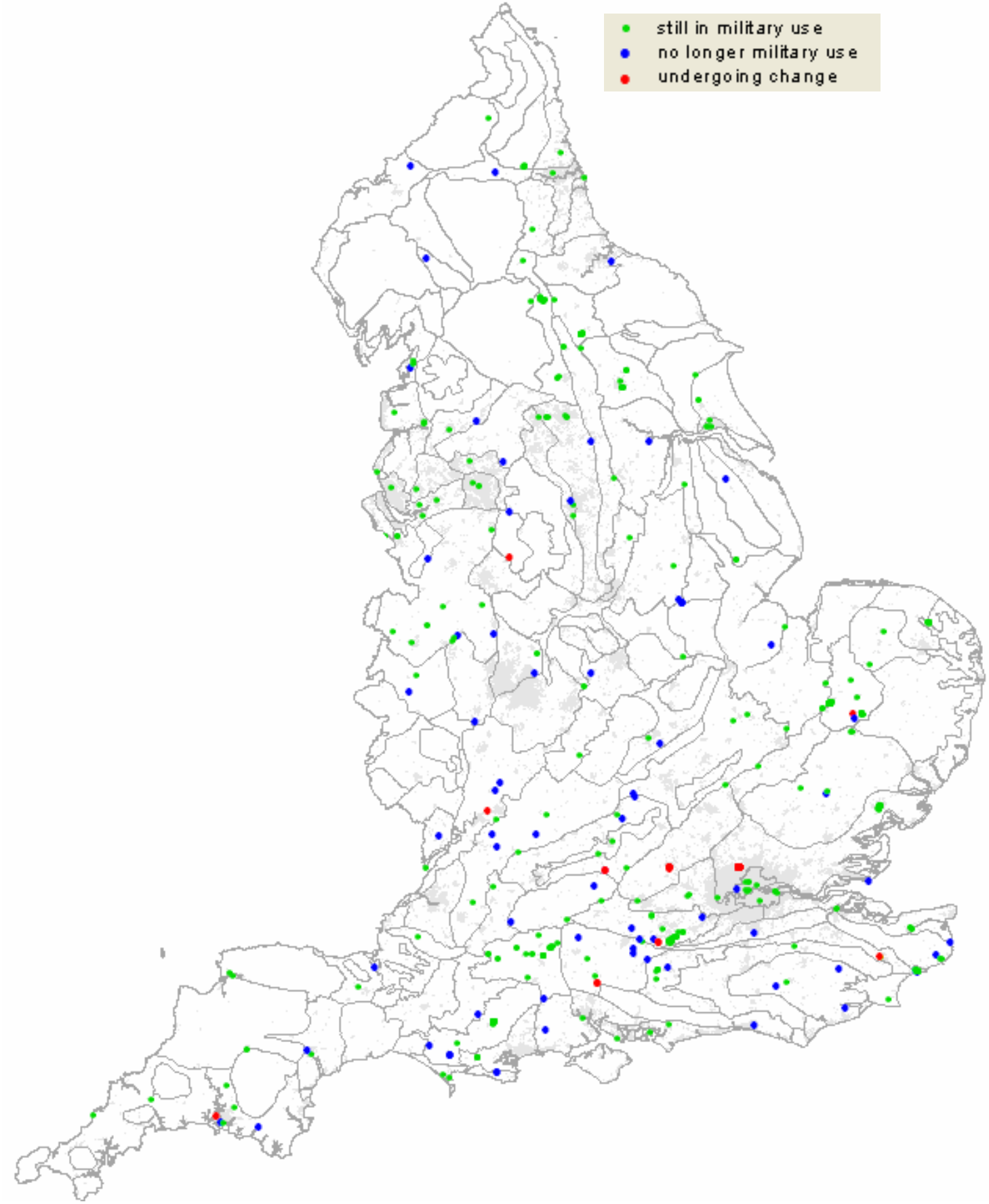
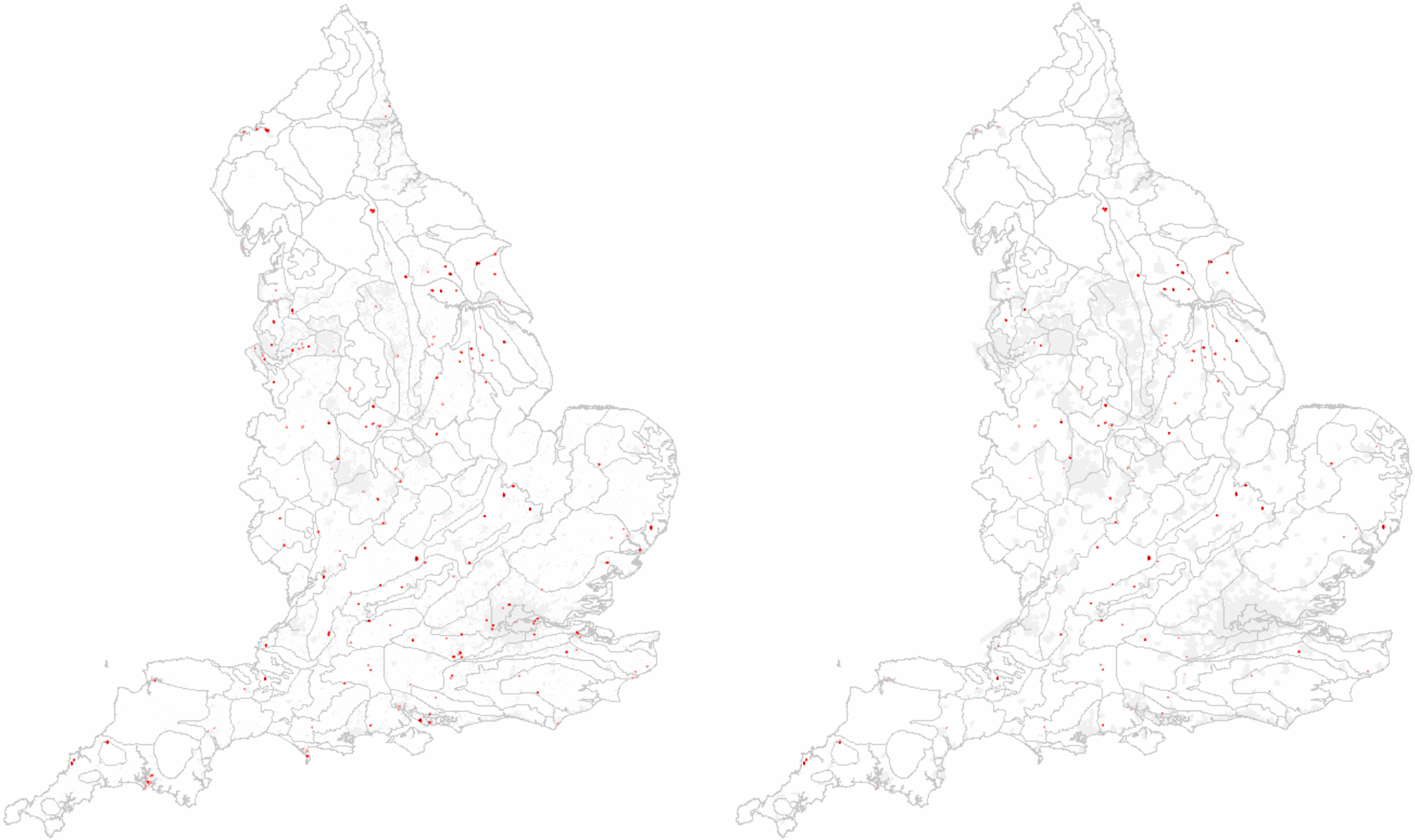


Figure 4.4: Extent of Land Available for Development previously in Defence Use (NLUD-PDL 2004) (grid = **Defence**)

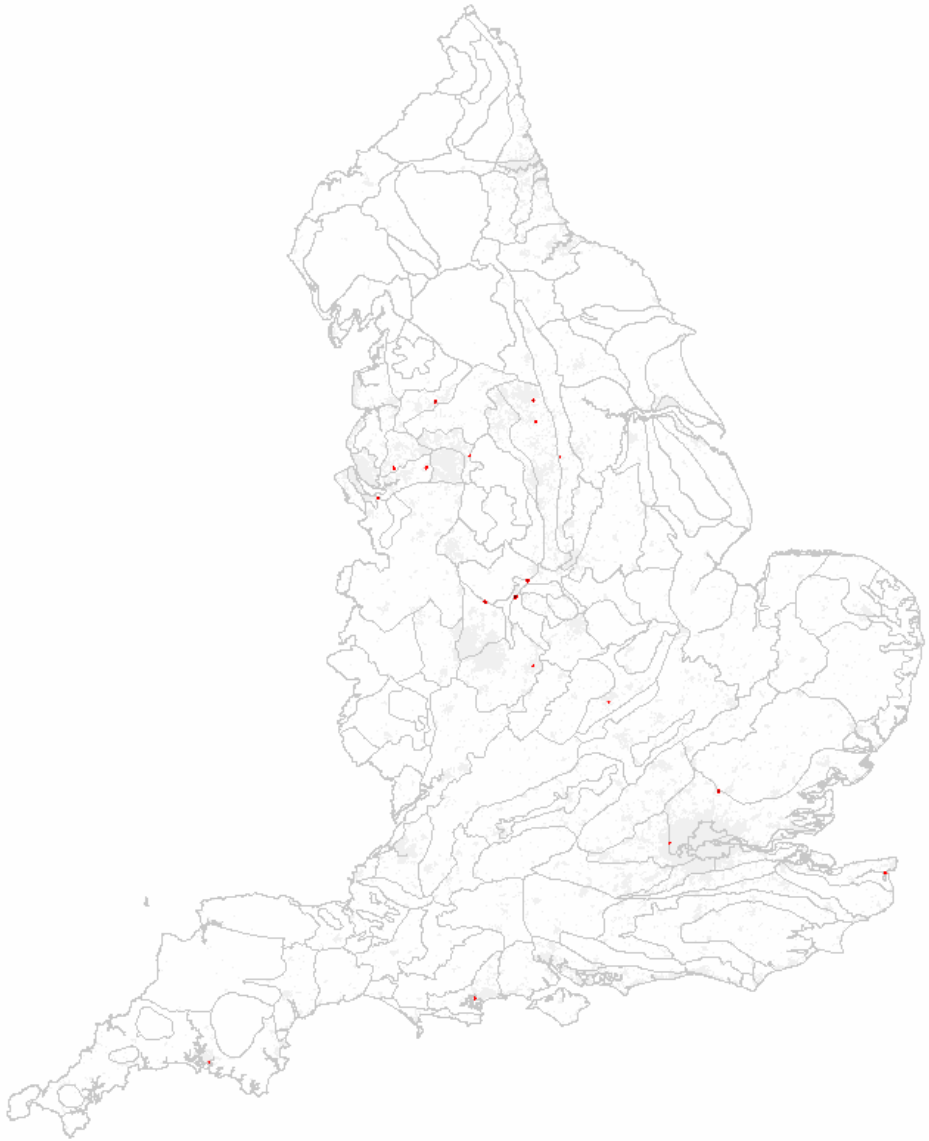


a) Locations within England

b) Locations within English rural domain only

Figure 4.4a shows in increasing intensity of red the stock of available brownfield land previously in defence use as a proportion of each hectare tile (as of 2004). Figure 4.4b shows similar information, but excludes urban areas with a population of 10,000 or more.

Figure 4.5: Extent of Land Available for Development previously used for Electricity Generation (NLUD-PDL 2004) (grid = **Powerstations**)

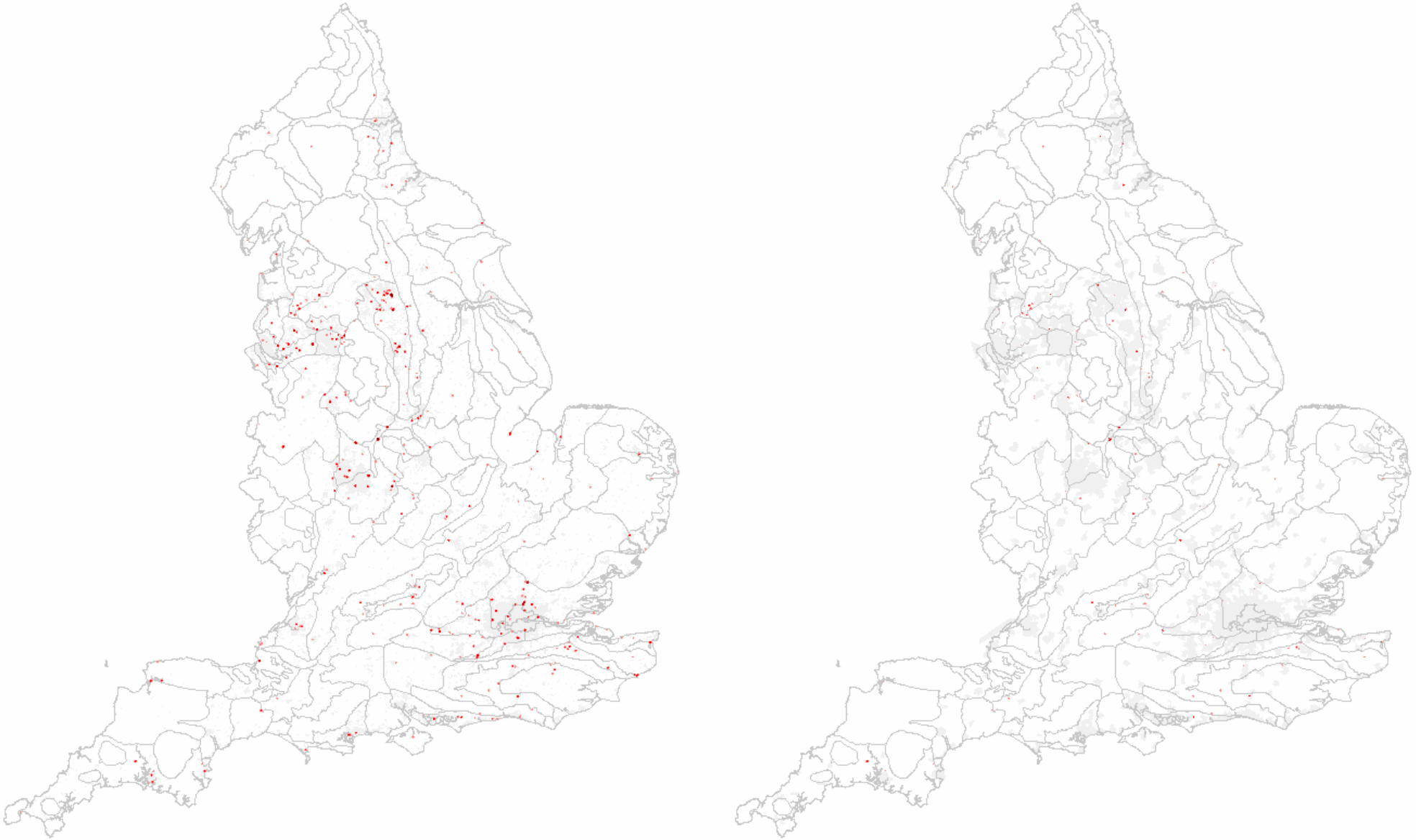


a) Locations within England

b) Locations within English rural domain only

Figure 4.5a shows in increasing intensity of red the stock of available brownfield land previously in electricity generation use as a proportion of each hectare tile (as of 2004). Figure 4.5b shows similar information, but excludes urban areas with a population of 10,000 or more.

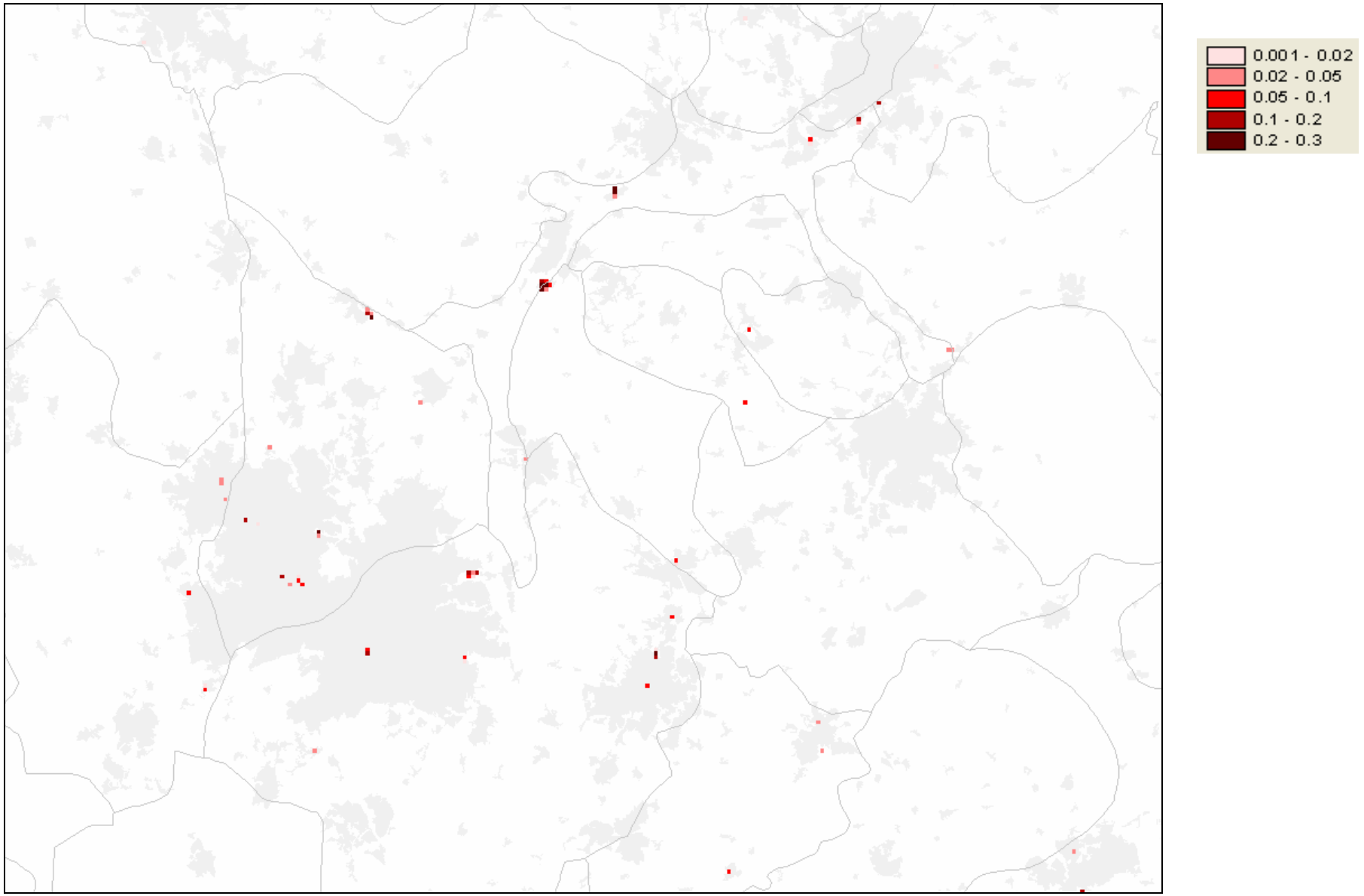
Figure 4.6: Extent of Land Available for Development previously used in Utilities Use (NLUD-PDL 2004) (grid = **Utilities**)



a) Locations within England

b) Locations within English rural domain only

Figure 4.6a shows in increasing intensity of red the stock of available brownfield land previously in utilities use as a proportion of each hectare tile (as of 2004). Figure 4.6b shows similar information, but excludes urban areas with a population of 10,000 or more.



c) Inset for Burton-On-Trent (depicting site size, hectares)

4.28 The contentious nature of planning applications for power generation facilities implies a presumption in favour of recycling of existing sites. Thus EDF Energy, for example, has submitted plans to build a 1,200MW gas-fired power station at its existing site in Sutton Bridge, Lincolnshire, by 2010. Nevertheless, their remains some possibility of development for other purposes. Hence while Eon (UK) submitted a planning application for a new gas-fired power station at Drakelow in 2005, the site retains an employment land allocation. The scale of this site is evident from the inset of the utilities grid illustrated in Figure 4.6c.

4.29 The scope of the present report precludes consideration (to any significant degree) of the factors which shape units of supply offered by the electricity generation industry. Nevertheless, this sketchy discussion not only hints at the potential merit of monitoring classes of extensive facility, but also shows quite clearly that macroscopic and microscopic concerns can be linked together.

Table 4.1: Large former Electricity Generation sites

NLUD description	Local Authority Area	Joint Character Area	Land (hectares)
Land adjacent to Rye House power station	Broxbourne Borough Council	Northern Thames Basin	7.1
Land east of Rye House power station	Broxbourne Borough Council	Northern Thames Basin	11.2
Former Rugeley power station	Cannock Chase District Council	Cannock Chase and Cank Wood	6.0
Former Ince power station	Ellesmere Port And Neston BC	Mersey Valley	19.2
Former Huncoat power station	Hyndburn Borough Council	Lancashire Valleys	23.3
Former Skelton Grange power station	Leeds City Council	Nottinghamshire, Derbyshire, and Yorkshire Coalfield	32.8
Former Rugeley power station	Lichfield District Council	Cannock Chase and Cank Wood	20.5
Former power station	Northampton Borough Council	Northamptonshire Vales	9.0
Former Poole power station	Poole UA	Dorset Heaths	9.2
Former Willington power station	South Derbyshire District Council	Trent Valley Wash Lands	74.9
Drakelow power station	South Derbyshire District Council	Trent Valley Wash Lands	33.3
Former Drakelow power station	South Derbyshire District Council	Trent Valley Wash Lands	99.8
Former Bold power station	St Helens Borough Council	Lancashire Coal Measures	9.7
Richborough power station	Thanet District Council	North Kent Plain	15.9
Carrington power station	Trafford Borough Council	Mersey Valley	16.5
Former Wakefield power station	Wakefield City Council	Nottinghamshire, Derbyshire, and Yorkshire Coalfield	17.0

Flows out of Institutional Use

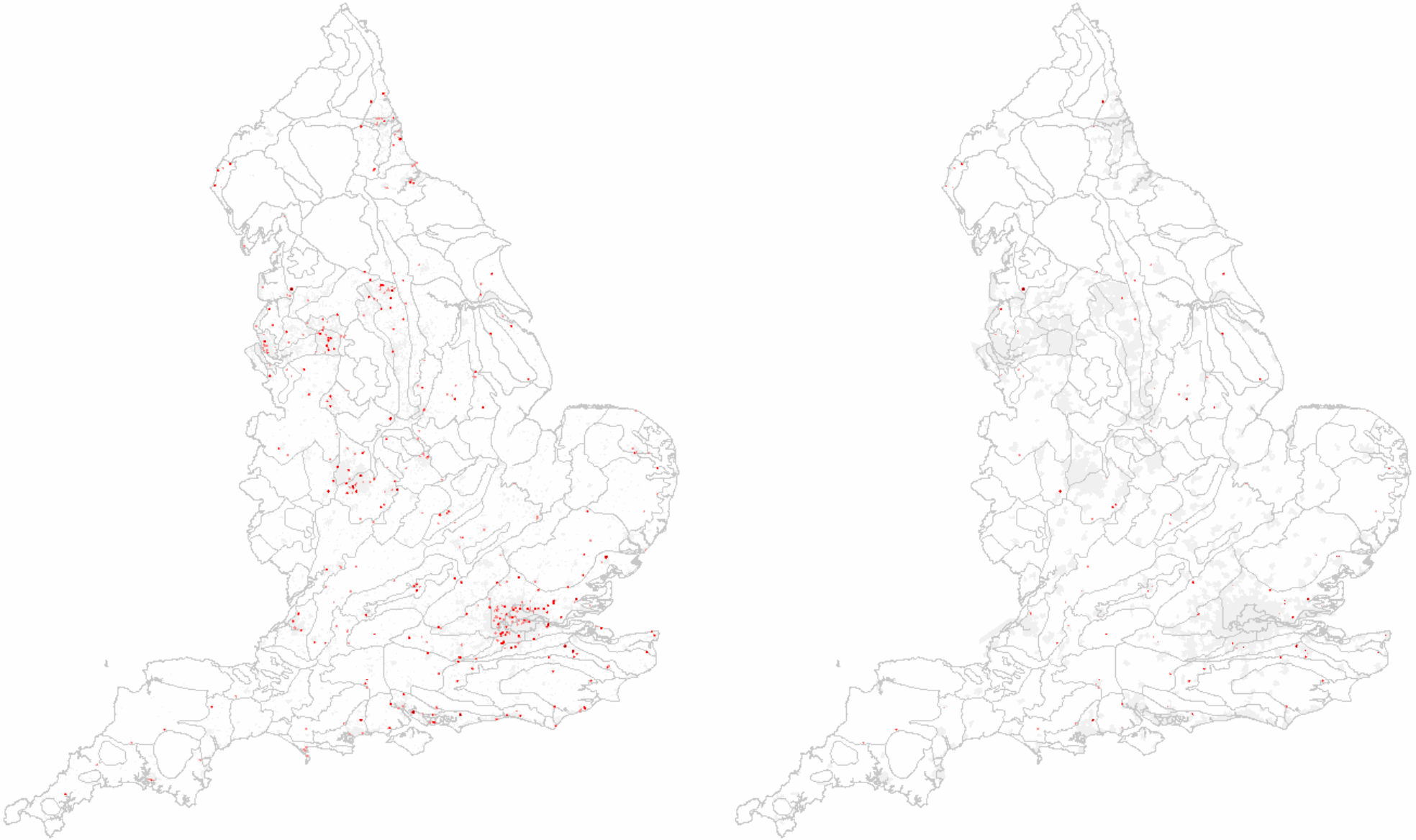
4.30 Within the framework put forward above, there is a substantial inertia in potential development units, allowing the nature of first development to exert substantial influence on subsequent development patterns. Nowhere is this clearer than in the case of institutions located in Victorian fringe belts. Nineteenth century social policy led to the development of large scale institutions such as Poor Law Union Workhouses, isolation hospitals, and lunatic asylums, in substantial grounds and beyond the city limits (in what is termed by urban morphologists the 'fringe belt'). Shifting policy implies the release of these sites but the nature of the land released clearly reflects the very particular choices made when these institutions were established.

4.31 For the purposes of the present project institutions recorded in the 1901 Census were treated as classes of facilities, and attempts made to match them with facilities (albeit of a different character) referenced by PAF for the second quarter of 2004. They were also matched against the portfolio of available sites within NLUD PDL for 2004. (Within NLUD PDL they appear within the institutional and communal accommodation category). The **Institutions** grid as depicted in Figure 4.7 has been constructed on the same basis as the LUCS grids discussed in Section 2. Over time parts of the fringe belt have been absorbed within the urban domain, hence a substantial proportion of these institutions are no longer in the countryside. Nevertheless, where they fall within the rural domain, their size carries significant implications for landscape as is suggested by Figure 4.7c which shows institutions around London and 4.7d which illustrates institutions around part of the north-west of England.

4.32 The larger sites include the Churchill Hospital and John Radcliffe Hospital sites in Oxford; and Cheshire County Lunatic Asylum at Upton by Chester; the latter being the site of a proposal for a major housing development within Green Belt (depicted within Figure 4.7d). In all there are 48 sites in excess of ten hectares (embracing in total 1082 has ie 10.82 square kilometres of land). This includes almost 38 has at the former Lancashire County Lunatic Asylum at Whittingham, east of Preston (shown in Figure 4.7d).

4.33 It is clear that despite shifts in policy after 1930, the absorption of these facilities within the NHS in the 1940s, and five decades of reorganization, there remains a substantial stock of institutional sites potentially available for redevelopment. By their nature, many fall within the rural domain and their previously-developed status potentially increases their acceptability as development sites from a planning policy perspective. Their release may potentially prompt significant landscape change.

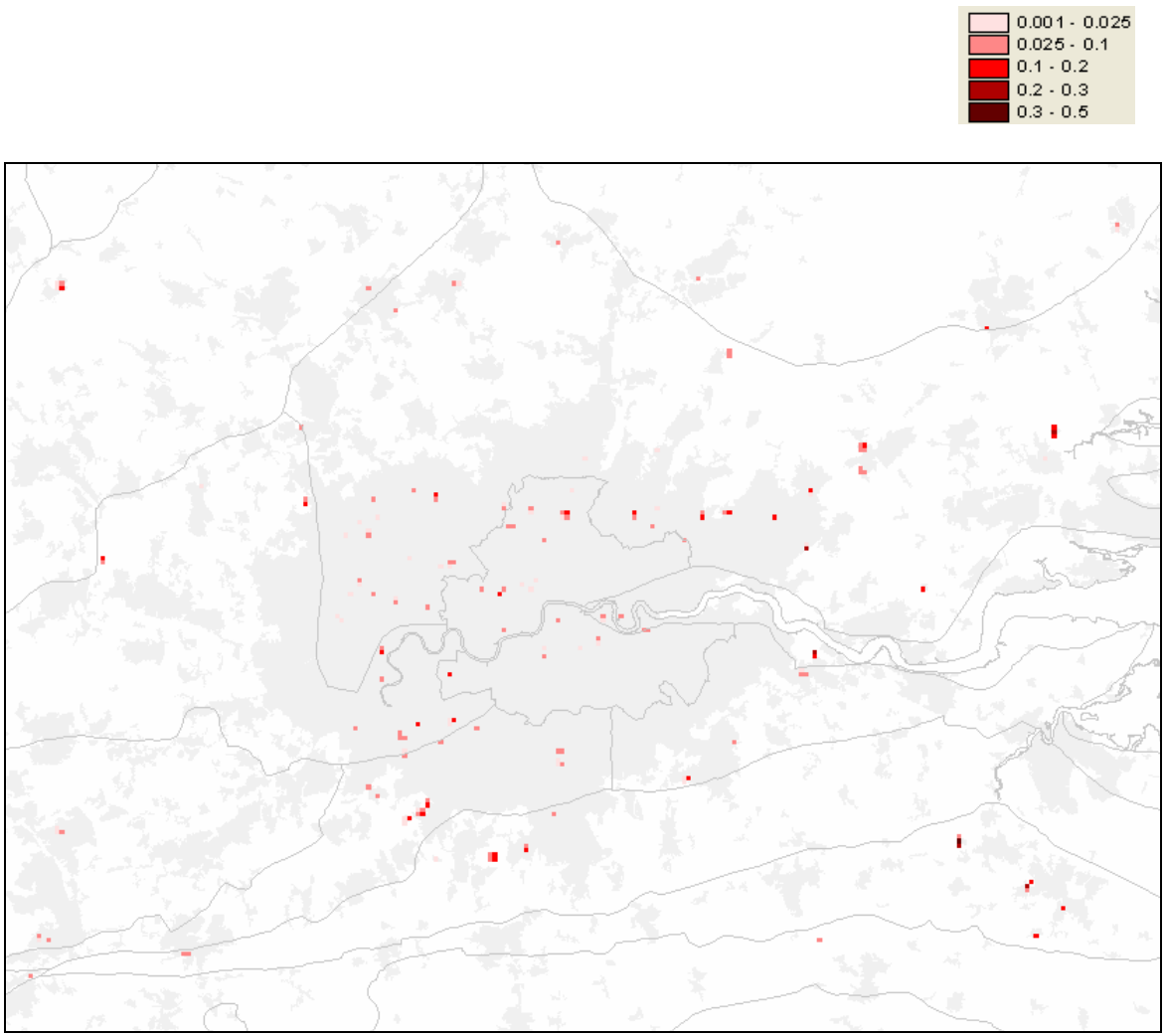
Figure 4.7: Extent of Land Available for Development previously in Institutional Use (grid = **Institutions**)



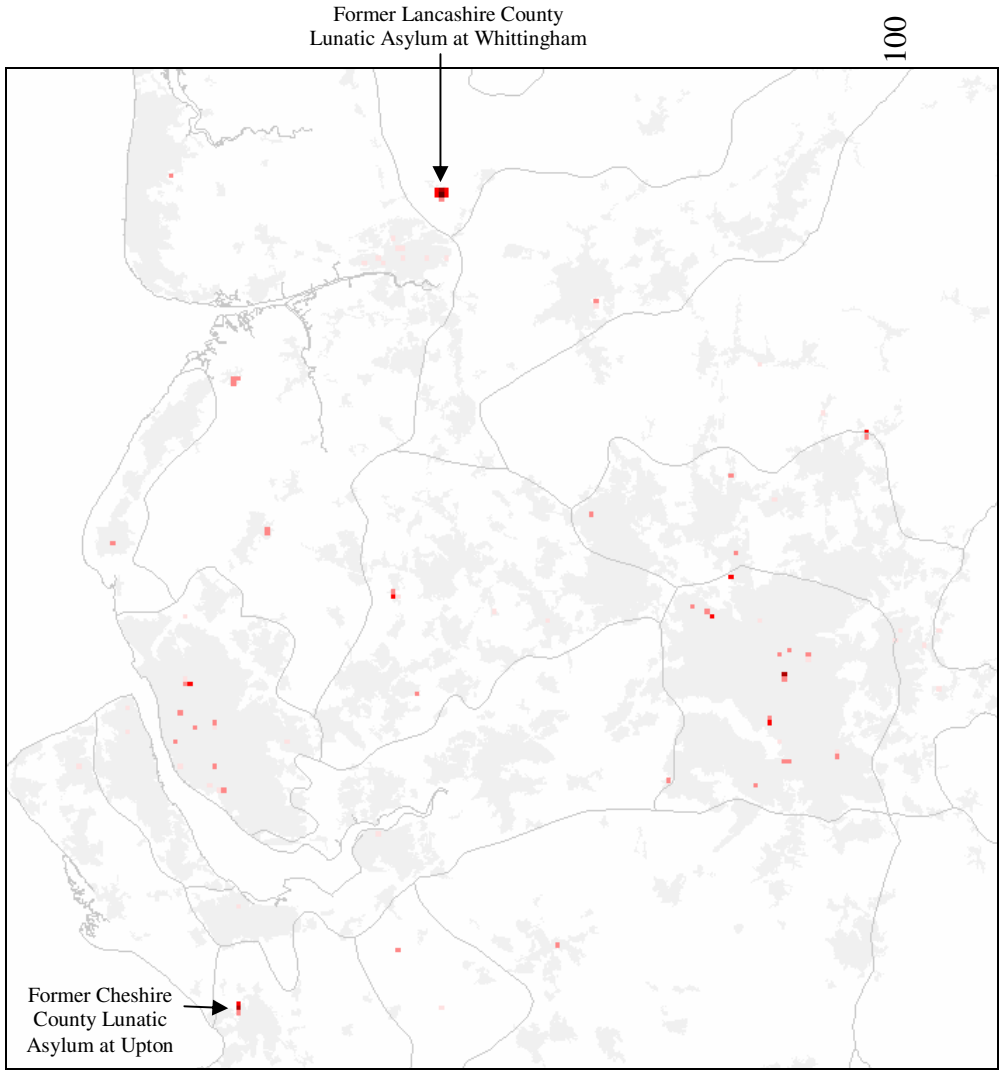
a) Locations within England

b) Locations within English rural domain only

Figure 4.7a shows in increasing intensity of red the stock of available brownfield land previously in institutional use as a proportion of each hectare tile (as of 2004). Figure 4.7b shows similar information, but excludes urban areas with a population of 10,000 or more.



c) Inset for Greater London (depicting site size, hectares)



d) Inset for the North-West (depicting site size, hectares)

Table 4.2: Large former Institutional Sites

NLUD-PDL Description	1901 Census Institution	JCA	Land (hectares)
Birch Hill Hospital, Birch Road, Wardle	Rochdale Union Workhouse Public Institution	Manchester Pennine Fringe	12.8
Brighton General Hospital, Elm Grove, Hanover	Brighton Workhouse	South Downs	5.8
Caistor Hospital, North Kelsey Road	Caistor Workhouse. Workhouse for paupers comprising Caistor Union	Mid Norfolk	5.5
Cane Hill Hospital, Portnalls Road, Coulsdon	London County Lunatic Asylum. Pauper Lunatic Asylum	North Downs	12.5
Cherry Knowle Hospital, Stockton Road Ryhope	Sunderland Borough Asylum General	Durham Magnesian Limestone Plateau	30.0
Churchill Hospital site, Roosevelt Drive, New Headington	Headington Union Workhouse. Workhouse for the paupers in Headington Union	Mid Vale Ridge	22.4
Eastry Hospital, Mill Lane, Eastry	Eastry Union Workhouse. Workhouse and Infirmary	North Downs	3.2
Farnborough Hospital, Farnborough Common	Bromley Union Workhouse. Union Workhouse	North Kent Plain	9.9
Former Hales Hospital, Yarmouth Road, Heckingham	The Workhouse Loddon and Clavering Union	South Norfolk and High Suffolk Clay Lands	3.2
Former Mapperley Hospital, Porchester Road, Greenwood	Borough Asylum - now called City Asylum Lunatic	Trent and Belvoir Vales	5.5
Former Queens Hospital, Queens Road, Croydon	The Workhouse Croydon Union Workhouse	Thames Basin Lowlands	3.9
King Edward VII Hospital, Birmingham Road, Hatton	County Asylum Lunatics	Arden	5.5
Linton Hospital, Heath Road, Coxheath	Maidstone Union. Union Workhouse	Wealden Greensand	4.0
Littlemore Mental Health Centre, Sandford Road, Littlemore	Littlemore (County) Asylum. Asylum For Pauper Lunatics	Mid Vale ridge	11.0
Oldchurch Hospital site, Waterloo Road, Romford	Romford Union Workhouse and Infirmary	Northern Thames Basin	7.8
Ormskirk Hospital, Wigan Road	Union Workhouse. Imbecile wards, vagrants wards, children wards, hospital and main building (5 Blocks)	Lancashire and Amounderness Plain	4.2
Prestwich Hospital, Bury New Road	Lancashire County Asylum Lunatic Asylum	Manchester Conurbation	4.0
Radcliffe Infirmary site, Woodstock Road, City Centre	Radcliffe Infirmary Headington	Upper Thames Clay Vales	3.7
Ryhope General Hospital, Stockton Road, Ryhope	Sunderland Borough Asylum General	Durham Magnesian Limestone Plateau	3.3
Site 1, former Whittingham Hospital, Whittingham Lane, rural west	County Lunatic Asylum. Asylum for Lunatics	Bowland Fringe and Pendle Hill	9.4
Site 10, former Whittingham Hospital site, Whittingham Lane, rural east	County Lunatic Asylum. Asylum for Lunatics	Bowland Fringe and Pendle Hill	12.0
Site 2, former Whittingham Hospital, Whittingham Lane, rural west	County Lunatic Asylum. Asylum for Lunatics	Bowland Fringe and Pendle Hill	9.0
Site 6, former Whittingham Hospital site, Whittingham Lane, rural east	County Lunatic Asylum. Asylum for Lunatics	Bowland Fringe and Pendle Hill	10.6
Site 7, former Whittingham Hospital, Whittingham Lane, rural east	County Lunatic Asylum. Asylum for Lunatics	Bowland Fringe and Pendle Hill	3.4
Site 9, former Whittingham Hospital site, Whittingham Lane, rural east	County Lunatic Asylum. Asylum for Lunatics	Bowland Fringe and Pendle Hill	15.4
Southmoor Hospital site, Southmoor Road, Hemsworth	Hemsworth Workhouse	Nottingham, Derbyshire and Yorkshire Coalfield	4.3
Walton Hospital site, Rice Lane, L9	Workhouse	Merseyside Conurbation	11.7
West Middlesex University Hospital, Twickenham Road	Brentford Union Workhouse Infirmary	Thames Valley	12.9
Wordsley Hospital, Stream Road, Wordsley	Kingswinford Union Workhouse	Mid-Severn Sandstone Plateau	9.4
Countess of Chester Hospital, Liverpool Road	Cheshire County Lunatic Asylum	Shropshire, Cheshire and Staffordshire Plain	40.0
John Radcliffe Hospital site, off Headley Way, Headington	Headington Union Workhouse. Workhouse for the paupers in Headington Union	Mid Vale Ridge	26.9
Land north of Oakwood Hospital, Hermitage Lane, Maidstone	Kent County Lunatic Asylum	Wealden Greensand	8.3
Land south of Oakwood Hospital, Hermitage Lane, Maidstone	Kent County Lunatic Asylum	Wealden Greensand	5.2
North Manchester Children's Hospital, Manchester Road, Swinton south ward	Manchester Workhouse. Workhouse and Hospital	Manchester Conurbation	5.0
North Manchester Children's Hospital, Manchester Road, Swinton south ward	Monsall Fever Hospital. Under control of the Manchester City Council	Manchester Conurbation	5.0
North Manchester Children's Hospital, Manchester Road, Swinton south ward	Prestwich Union Workhouse	Manchester Conurbation	5.0
Southern Campus Royal Shrewsbury Hospital, Mytton Oak Road, Copthorne	Salop and Montgomery Counties, and Wenlock Borough Lunatic Asylum	Shropshire, Cheshire and Staffordshire Plain	3.2
St Andrews House, Oakwood Hospital, Hermitage Lane, Maidstone	Kent County Lunatic Asylum	Wealden Greensand	4.2
Walsgrave Hospital, Clifford Bridge Road, Coventry	Coventry Poor Law Union Workhouse	Arden	29.1
Warneford Hospital, site Warneford Lane, Headington	Headington Union Workhouse. Workhouse for the paupers in Headington Union	Mid Vale Ridge	8.6

5. Glossary of Terms

Brownfield	An area or parcel of land that has previously been developed.
Champion belt	An expanse of agricultural country; a plain unbroken by hills or woods.
Greenbelt	An officially designated belt of open countryside in which development is severely restricted, usually enclosing a built-up area and designed to check its further growth.
Greenfield	An area or parcel of undeveloped land, typically used for agriculture.
Hypernym	A superset of a hierarchical structure. For example, a vehicle encompasses a collection of means of transport, including subsets such as automobiles, trains, aeroplanes, etc.
Hyponomy	The relationship between hypernym and hyponym. A hyponym refers to a class which is a subset of a hypernyn or superclass.
Hyponym	A subset of a hierarchical structure. For example, automobiles are a subset of vehicles, as are trains, aeroplanes, etc.
Joint Character Area (JCA)	England's landscape is divided into 159 different character areas. These are broad areas of countryside, such as the Cotswolds or Chilterns, that are unique in terms of a combination of physiographic, land use, historical and cultural attributes.
Land Cover Map (LCM)	A survey of UK land cover using remote sensing (satellite) data. Produced by the Centre for Ecology and Hydrology (CEH) in 1990 and 2000.
Land Use Change Statistics (LUCS)	Collected on behalf Office of the Deputy Prime Minister (ODPM) by Ordnance Survey (OS) during the course of their map revision programme, when the current land use category of a parcel of land differs from that depicted in OS records.
Lexicon	A set of words.
Local Development Framework (LDF)	The local element of the statuary development plan, introduced in England and Wales by the Planning and Compulsory Purchase Act 2004.
Locality Dependant Locality Double Dependant Locality	Refers to the Locality record within PAF. Dependent locality areas may define an area within a post town. A double dependant locality is used in a more limited number of cases to distinguish between similar or same thoroughfares within a dependent locality. For example, Browns Lane (throughfare), Melton Business Park (double dependant locality), Stanton-On-The-Wolds (dependant locality), Keyworth (locality).
Meronymy	Specifies what may be held to form *part* of what. For example, a car park and access roads may form part of a retail park.
National Inventory of Woodland and Trees (NIWT)	Digital woodland map held by the Forestry Commission, showing woodland by broad interpreted forest types. The main data were derived from 1:25000 aerial photography (flown 1991-2000), supplemented by digitised areas of Woodland Grant Schemes (WGS) and Forest Enterprise New Planting.
National Land Use Database for Previously Developed Land (NLUD-PDL)	This consists of data returned by Local Authorities on vacant and derelict sites and other previously developed land and buildings that may be available for redevelopment in England. See http://www.nlud.org.uk/ for more information.

Ontology	An explicit description of the objects, concepts, and other entities that are assumed to exist and the relationships that hold among them (Genesereth & Nilsson, 1987).
Ordnance Survey (OS)	The national mapping agency of Great Britain. See http://www.ordnancesurvey.co.uk for more information.
Ordnance Survey's Meridian (OSM)	Meridian is a mid-scale digital representation of Great Britain supplied by Ordnance Survey (OS). The product is typically viewed at 1:50,000 and at this scale the generalisation of its features maintain geometric integrity and accuracy. Features include roads, urban areas, lakes, and areas of woodland, for example.
Periurban	Generally, pertaining to the urban margin. In this document it refers specifically to a periurban zone defined on the basis of a methodology set out in Bibby and Shepherd (2004), and discussed in paras 3.14 and 3.15.
Postal Address File (PAF)	UK Address database from Royal Mail, containing over 27 million addresses held at unit postcode centroid level (e.g. S10 2TN) with an accuracy of 100 metres. Also known as Postzon.
Thoroughfare Dependant Thoroughfare	Refers to the Thoroughfare record within PAF, which fundamentally is a road, track or named access route on which there are Royal Mail delivery points. A dependant thoroughfare is used to distinguish between similar or same thoroughfares within a dependent locality. For example, parades of shops on a High Street where different parades have their own identity (e.g. The Square, High Street).
Urban fringe	In this document it refers specifically to a zone defined on the basis of a methodology set out in Bibby and Shepherd (2004), and discussed in paras 3.14 and 3.15.
Wood-pasture belt	Areas of wood pasture are defined by the presence of trees in a habitat which is kept open by grazing animals. They often occur where the woodland and its grazing system have evolved in parallel over time to produce a grazing maintained habitat with elements of both woodland and pasture.

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