British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Establishing data on normal/background levels of soil contamination in England

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Defra Project SP1008

RSC-SoBRA Meeting 21st December 2011

Current Issues in Contaminated Land Risk Assessment -2011

Presentation outline

- **context – statutory guidance revision**
- **Project Approach – Four work packages**
- **definitions - Normal background & Contaminants**
- **work packages 1 & 2 – data sets and exploration**

Outline of Project Approach

WORKPACKAGE 2

DATA EXPLORATION

[Louise Ander]

WORKPACKAGE 1

DATA AND KNOWLEDGE BASE

[Barbara Palumbo-Roe]

WORKPACKAGE 3

Methodology to establish and interpret "normal" levels of background contamination

[Mark Cave]

18th January 2012

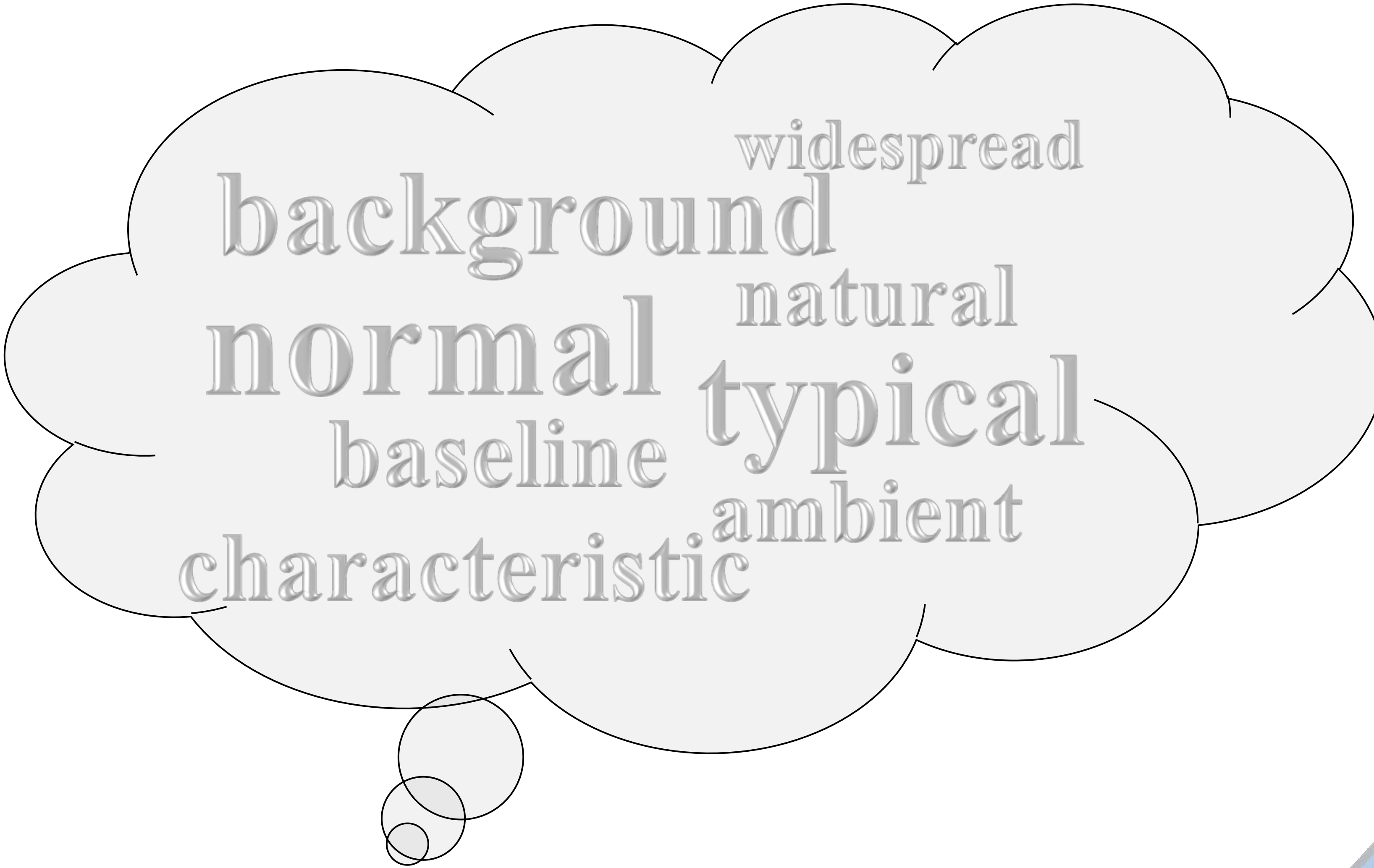
WORKPACKAGE 4

TECHNICAL GUIDANCE

[Chris Johnson]

www.bgs.ac.uk/gbase

- Research Highlights
  - Background Concentrations in Soils (BCCS) project


widespread
background
natural
normal
typical
baseline
ambient
characteristic

Definitions - Background

Mineral Exploration Definition

- *Area of normal element concentrations (in various sample media) distinguished from anomalously high concentrations (that may be indicative of metalliferous mineralisation) by a threshold value*

Environmental Geochemistry Definition

- *A relative measure to distinguish between natural element or compound concentrations and anthropogenically-influenced concentrations in real sample collectives (Matschullat et al. 2000)*

ISO soil background content guidance

- Content of a substance in a soil resulting from both natural geological and pedological processes and including diffuse source inputs (BS EN ISO 19258)

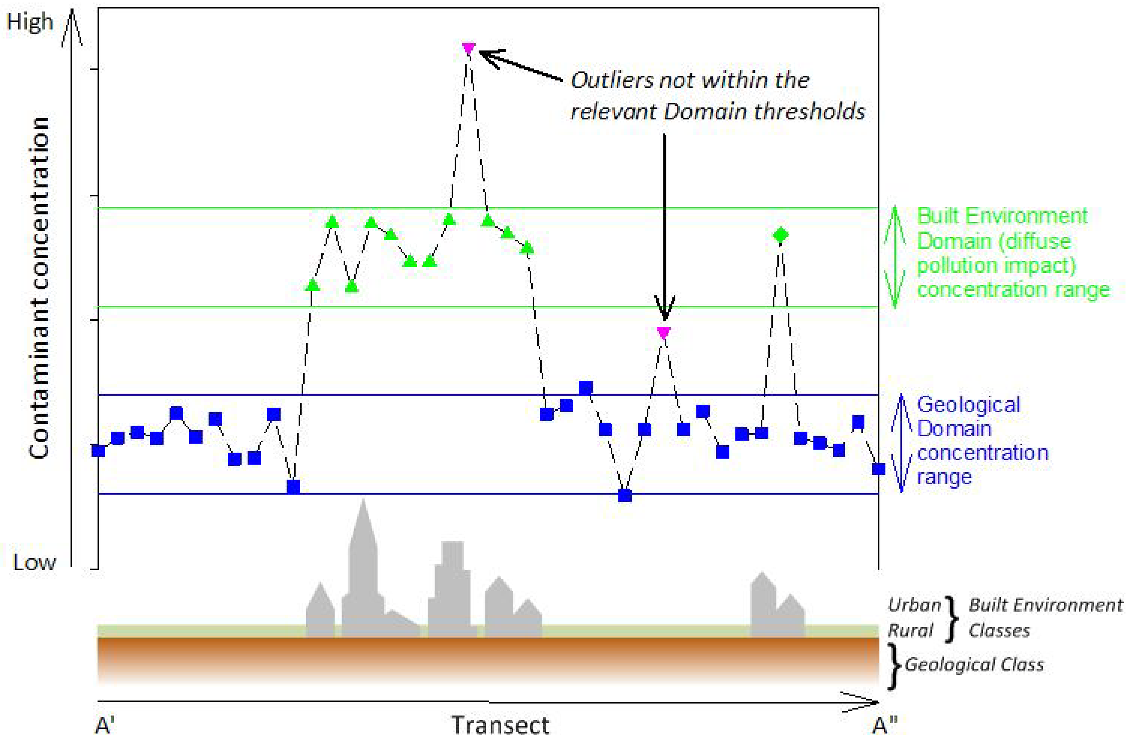
Normal Background – Statutory Guidance

Revised Statutory Guidance (Section3) –
"normal" presence/**levels** of contaminants

- should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise
- may result from the natural presence of contaminants at levels that might be considered **typical** in a given area, and have not been shown to pose an unacceptable risk to health or the environment
- caused by low level diffuse pollution, and common human activity other than specific industrial processes.

Decisions – are contaminant concentrations typical or widespread in my area/similar areas?

Backgrounds vary spatially



Contaminant - definition

The terms "contaminant", "pollutant" and "substance" have the same meaning – i.e. they all mean a substance relevant to the Part 2A regime which is in, on or under the land and which has the potential to cause significant harm to a relevant receptor, or to cause significant pollution of controlled waters

Contaminant List

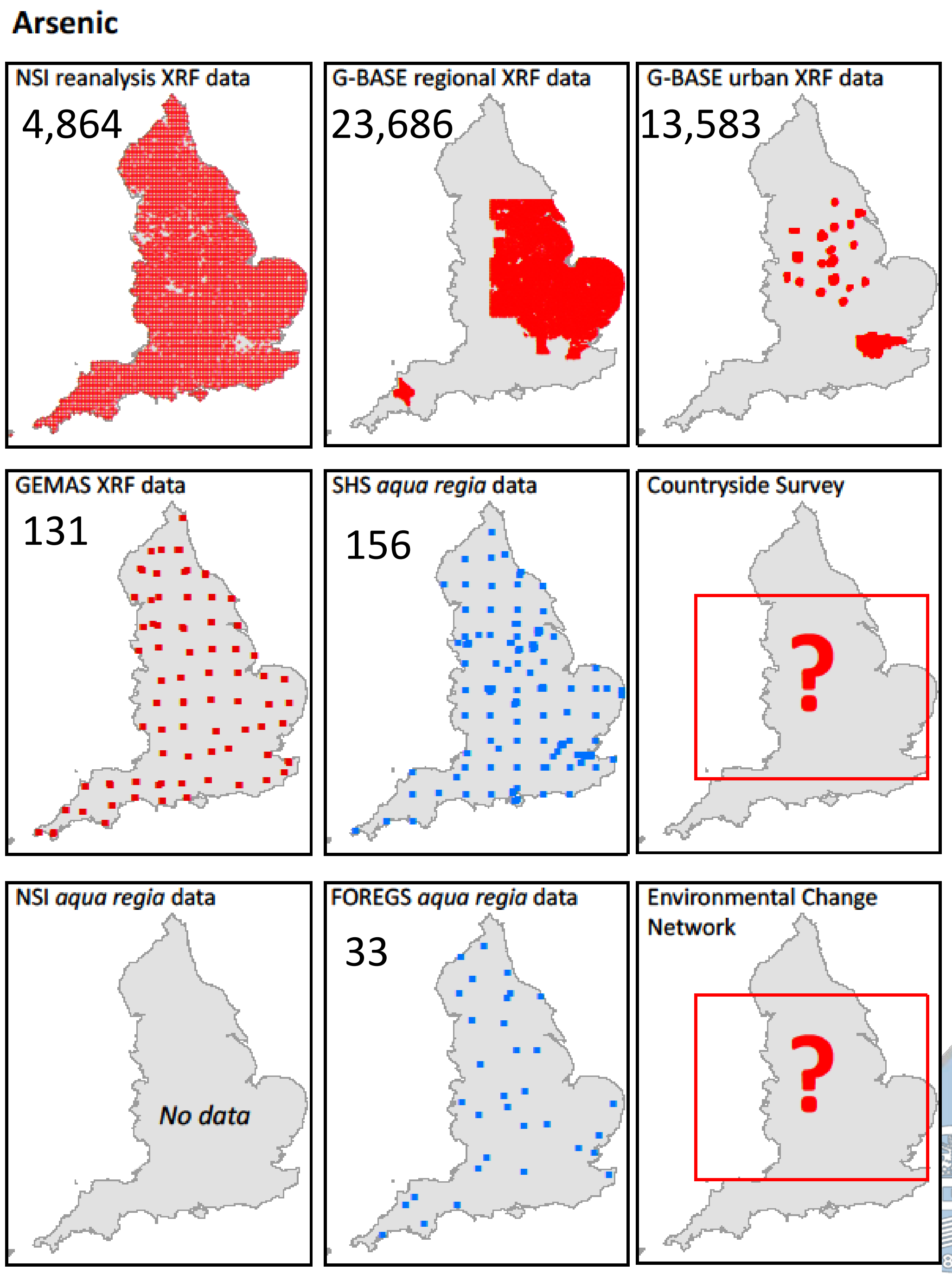
Inorganic	*Organic*	
arsenic	acetone	fenitrothion
beryllium	aldrin	hexachlorobuta-1,3-diene
cadmium	atrazine	hexachlorocyclohexanes
chromium	azinphos-methyl	malathion
copper	benzene	naphthalene
lead	benzo[a]pyrene	organolead compounds
mercury	carbon disulphide	organotin compounds
molybdenum	carbon tetrachloride	pentachlorophenol
nickel	chloroform	phenol
selenium	chlorobenzenes	polychlorinated biphenyls
sulphur	chlorophenols	polycyclic aromatic hydrocarbons
thallium	chlorotoluenes	tetrachloroethane
vanadium	1,2-dichloroethane	tetrachloroethene
zinc	dichlorvos	toluene
cyanide	DDT	total petroleum hydrocarbons
asbestos	dieldrin	2, 1,1,1-trichloroethane
	dioxins and furans	trichloroethene
	endosulfan	trifluralin
	ethylbenzene	vinyl chloride
	explosives	xylenes

Martin, I. and Cowie, C. 2008. Compilation of data for priority organic pollutants for derivation of Soil Guideline Values. Environment Agency, UK SC050021/SR7. 171pp

Work package 1 – soil data sets

- LUCAS project
- BIOSOIL
- Peer reviewed publications

- BGS Mineral Reconnaissance Programme (MRP)
- Site investigations



Soil data set issues

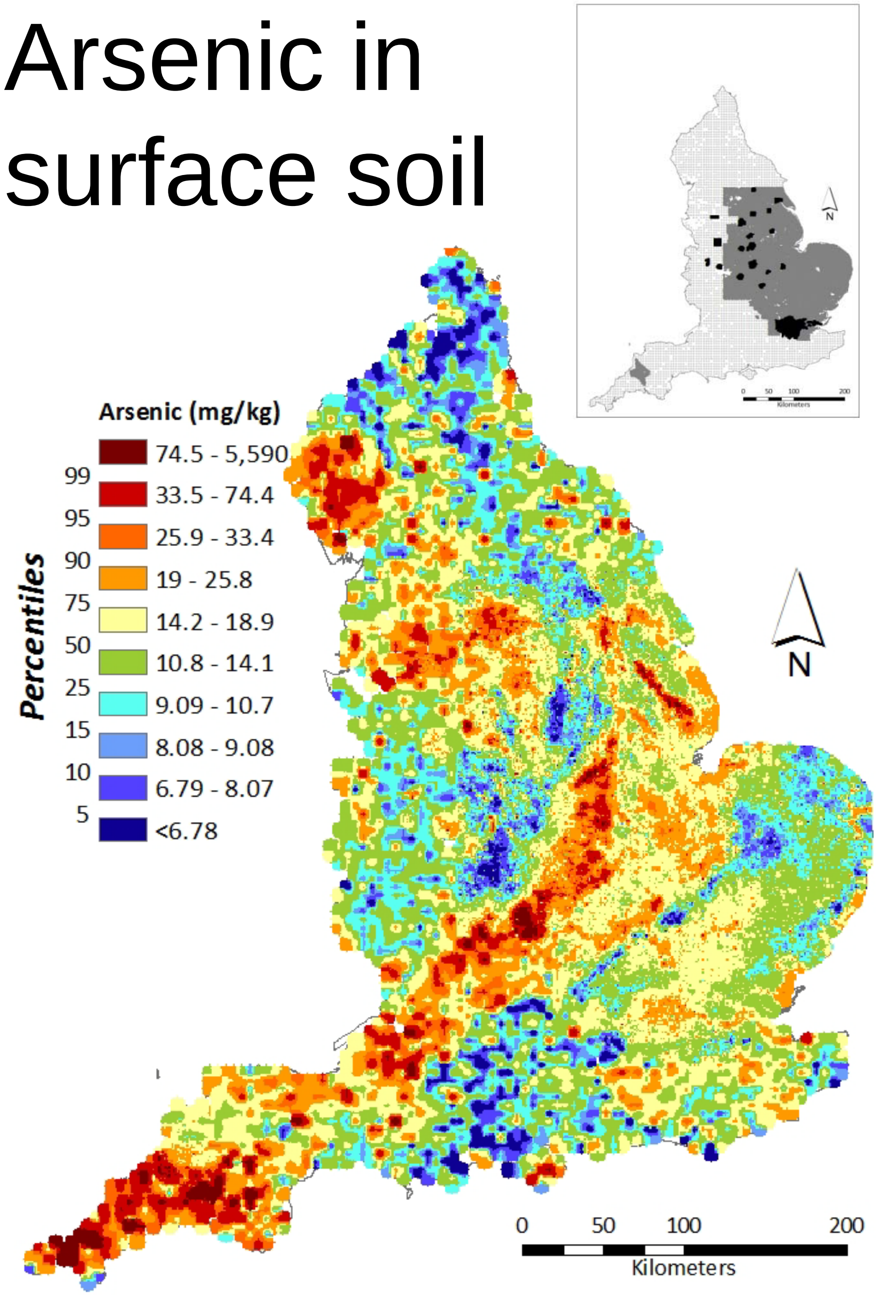
- soil contaminant concentrations must be determined according to well defined standards of sample collection and analytical methodology ~ you can only compare like with like

- extrapolate sites (points) to represent areas ~ composite samples and high density of sites improves confidence

- we are looking at normal concentrations for local areas, regions or nationally and are not targeting specific sites or land use

Work Package 2 – Data Exploration

Arsenic in surface soil



Key environments that have higher arsenic concentrations

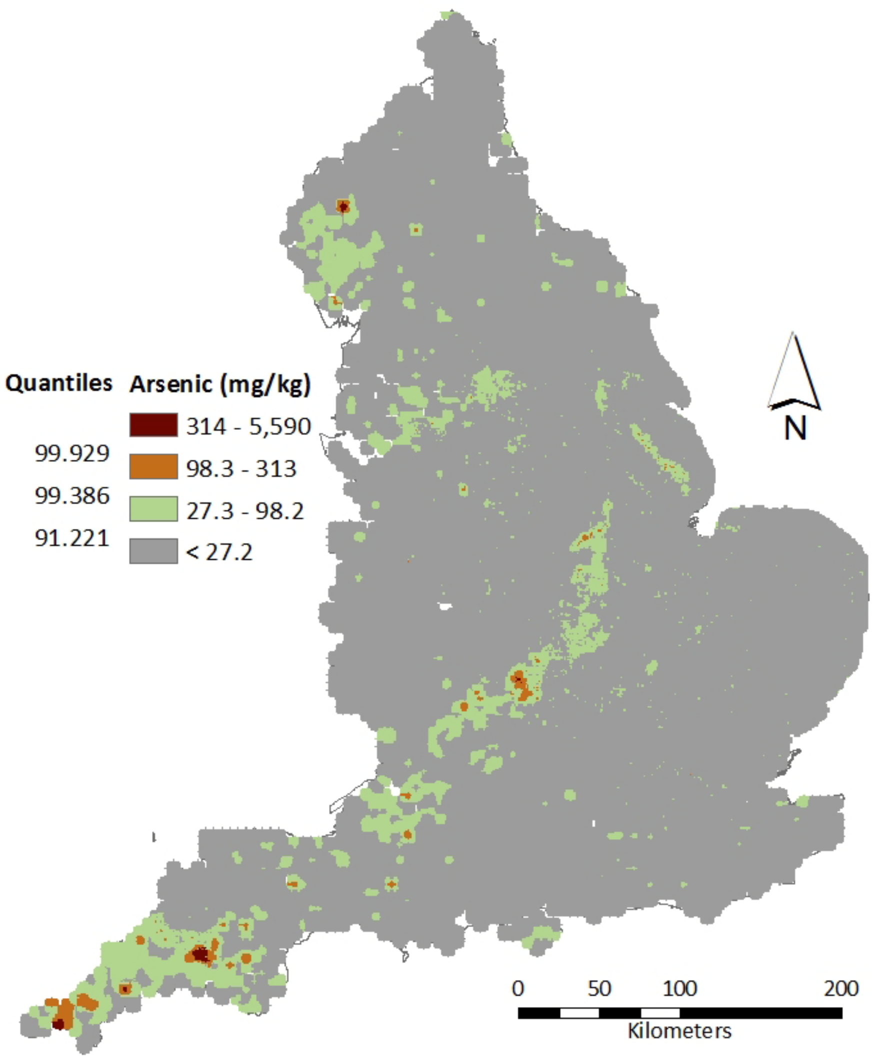
Geological –
- ironstones
- Fen and upland peats

Mineralisation and mining –
- Lake District
- Mendips
- south-west England

Built environment –
- London
- Manchester
- Sheffield

Work in progress – not to be used externally

Arsenic in surface soil

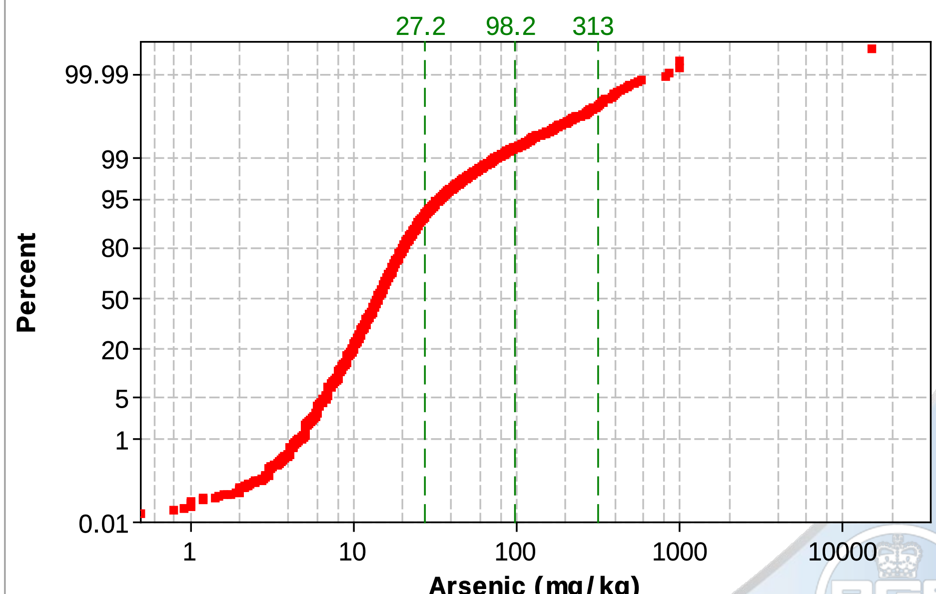


Work in progress – not to be used externally

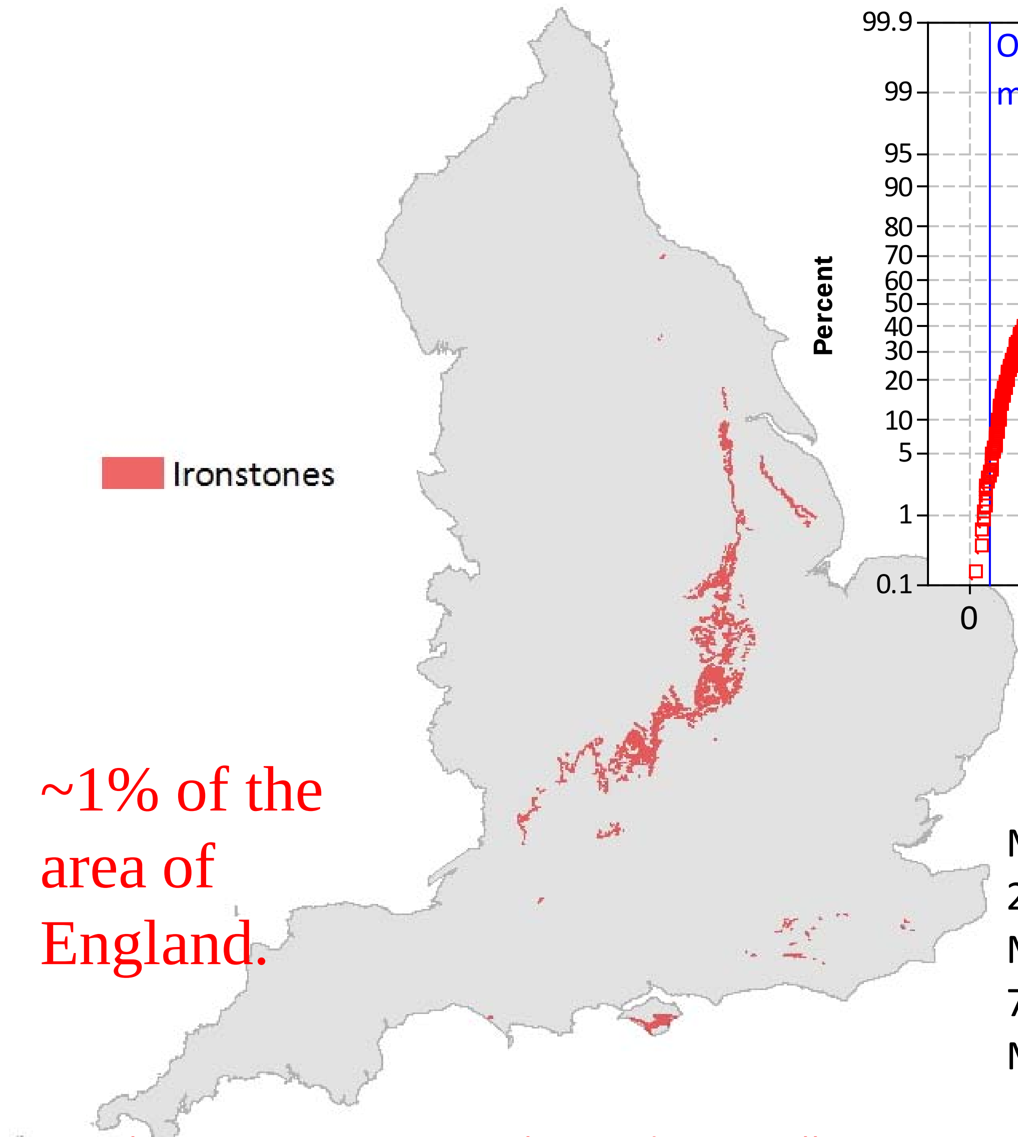
Data partitioned using the K-means cluster method.

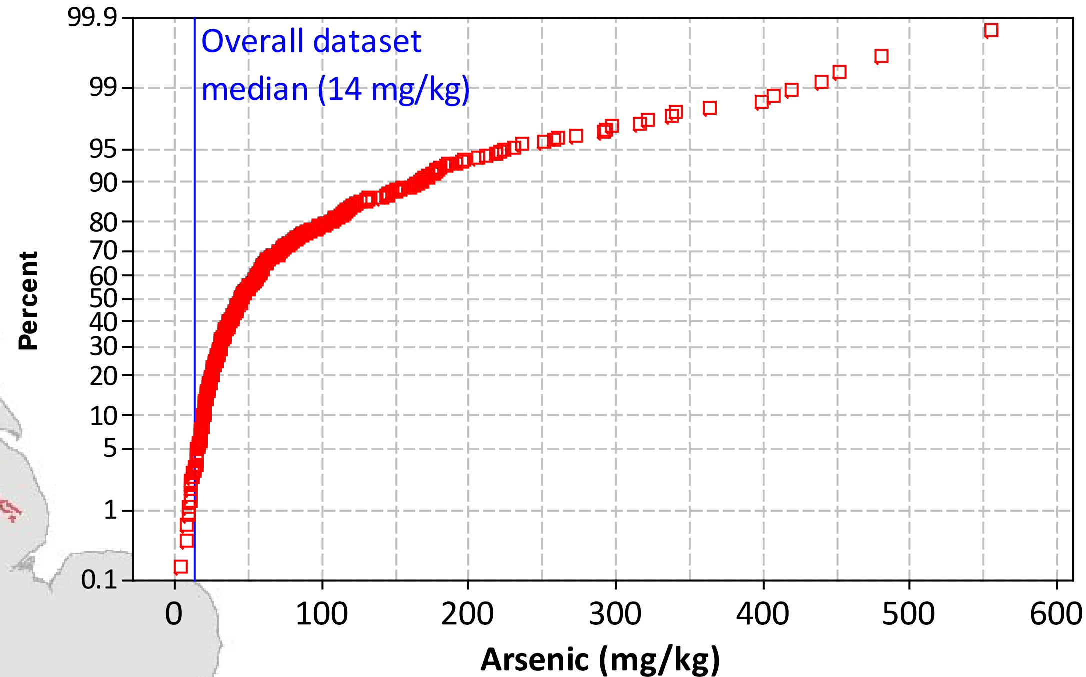
Thresholds found are:

Percentile	Arsenic (mg/kg)
99.93%	313
99.39%	98.2
91.22%	27.2



Key spatial datasets (1): Parent Material Map *Ironstones*





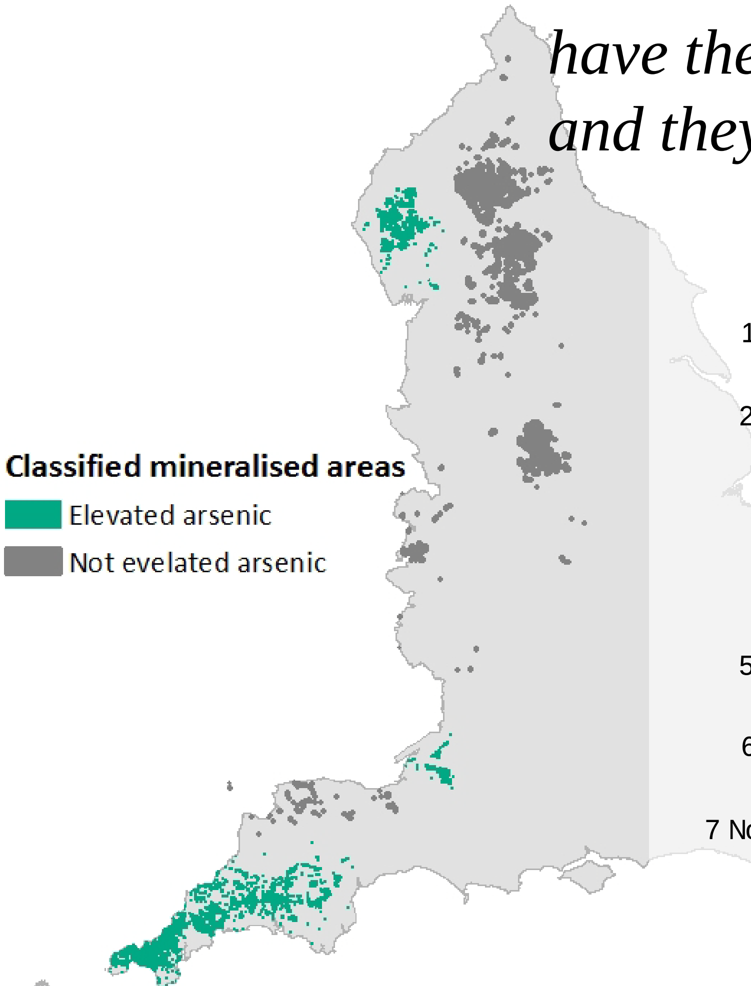
~1% of the area of England.

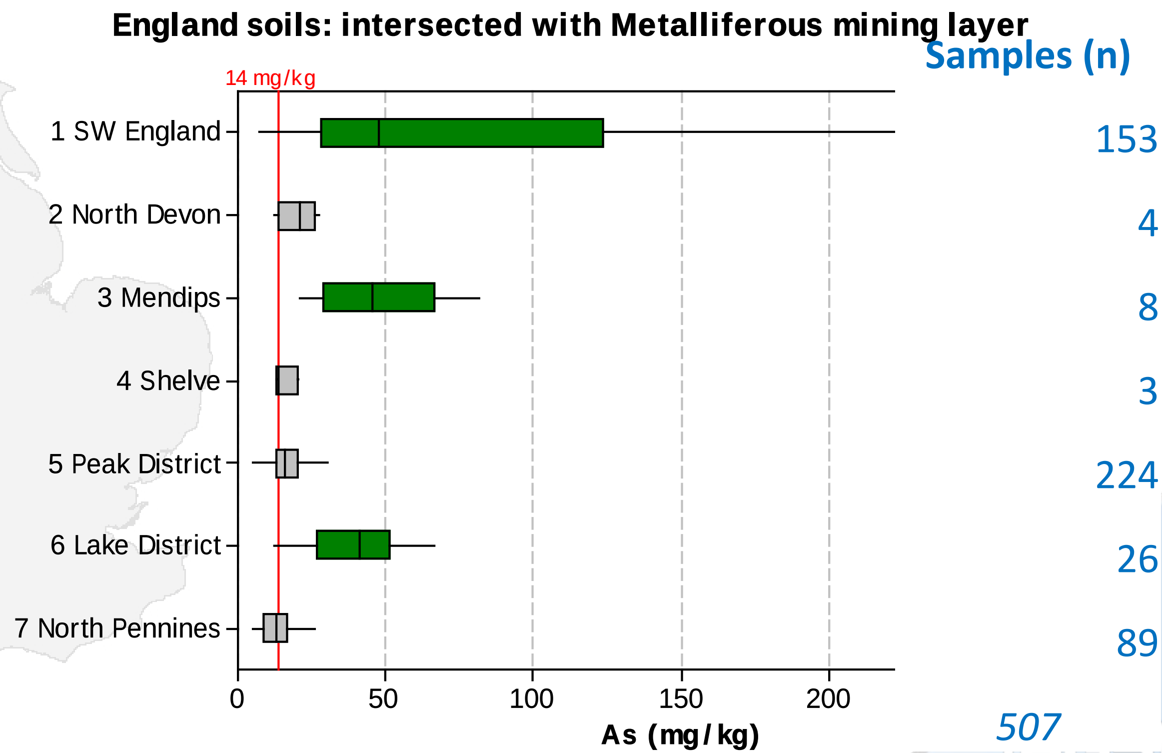
Minimum	4.05	Mean	72.9
25th percentile	27.8	Skewness	2.8
Median	45.0	Count	437
75th percentile	83.4		
Maximum	555		

Work in progress – not to be used externally

Key spatial datasets (2): Mineralisation and mining

Not all mineralisation areas have the same chemical composition, and they can be classified accordingly.





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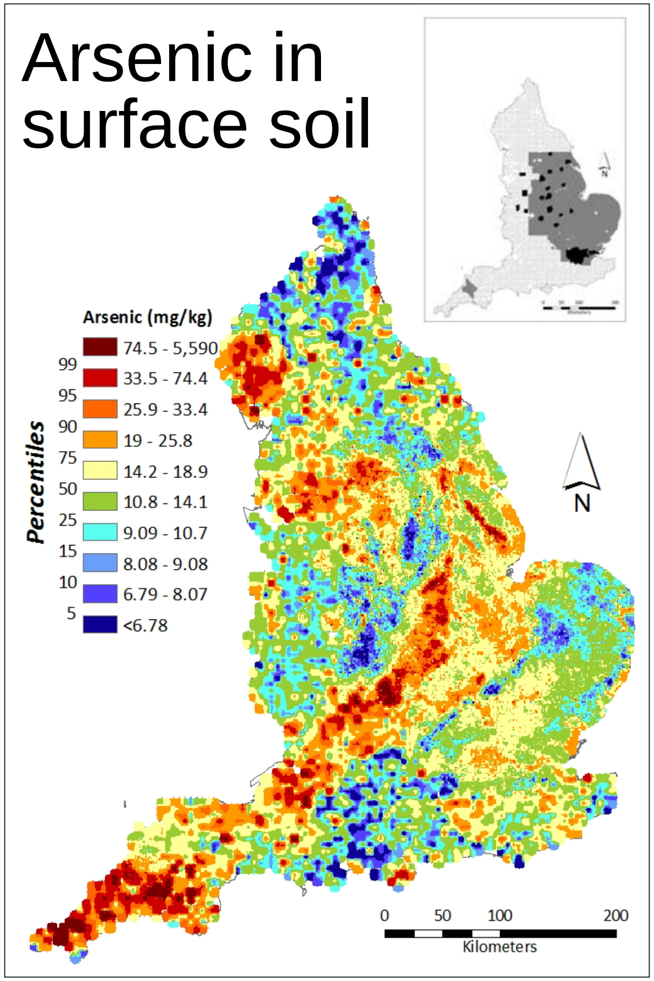
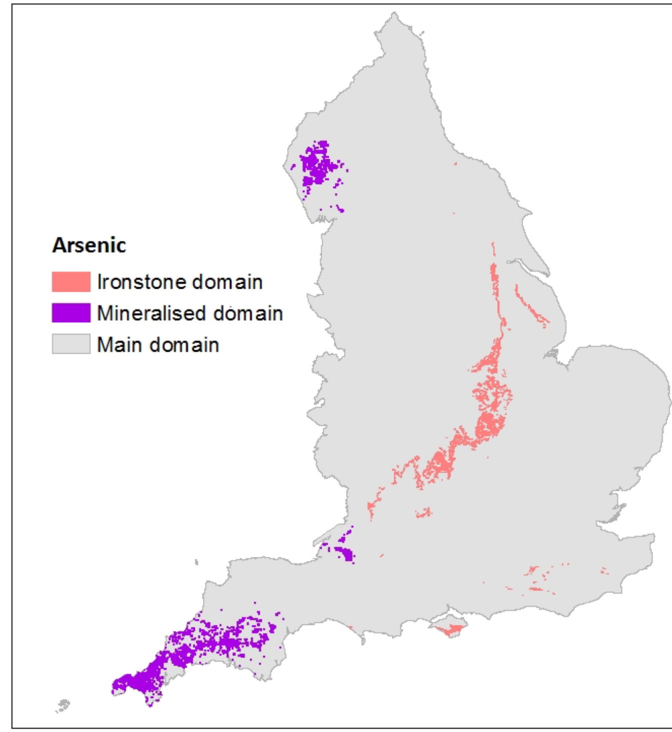
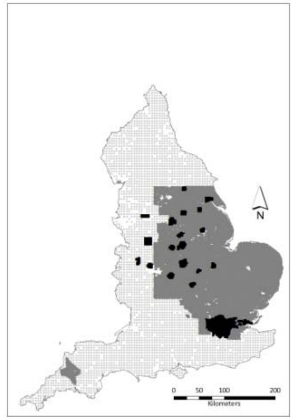
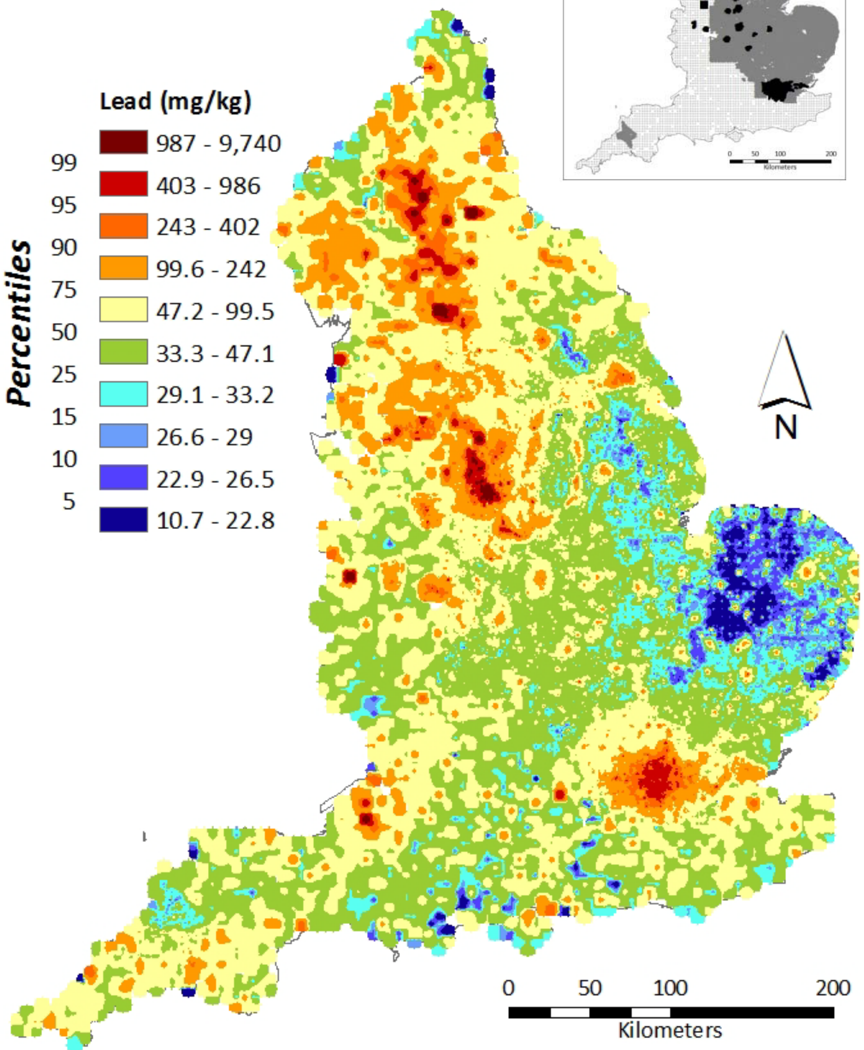




Work in progress – not to be used externally

Lead in surface soil





Work in progress – not to be used externally

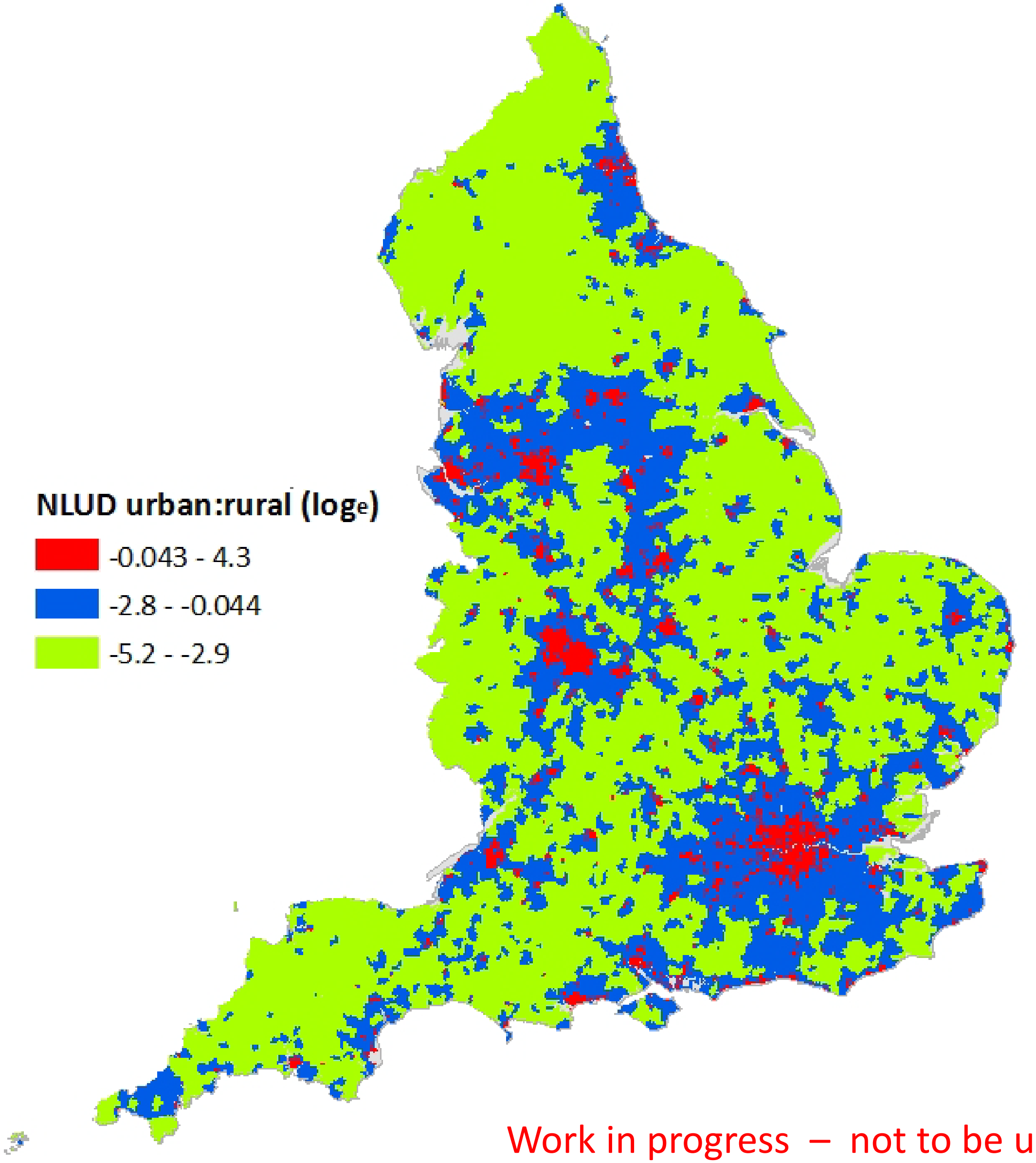
Key environments that have higher lead concentrations

Geological –
(only mineralised)

Mineralisation and mining –
Lake District
North Pennines/Peak District
Mendips

Built environment –
London
Most sampled urban centres

Key spatial datasets (3): land use classification options *NLUD*



- Domestic Buildings
- Domestic Gardens
- Non Domestic Buildings
- Road
- Rail

- Path
- Greenspace
- Water
- Other Land Uses
- Unclassified Land