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Assessing the Effect of Urbanisation on Diffuse pollution in English Soils

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Abstract

Background concentrations of contaminants in soil include natural geological and pedological processes and diffuse source inputs. Whilst natural sources can be identified from information on underlying parent material sources, diffuse anthropogenic pollution needs to be defined by a different approach. Diffuse pollution arises where substances are widely used and dispersed over an area as a result of land use activities, often associated with industrial and urban development. These activities (recent or in the past) cannot be tied down to a specific location or source. Examples of diffuse pollution include atmospheric deposition of contaminants arising from industry, domestic coal fires and traffic exhaust, and disposal of domestic coal ash onto garden soil.

A simple approach to defining regions of diffuse pollution is to link them to urbanisation. The UK Office for National Statistics provides data on the built environment through the Generalised Land Use Database (GLUD) Statistics for England 2005. This data set is particularly suitable for implementing a measure of urbanisation. The GLUD supplies land use statistics for 8850 Census Area Statistical Wards(CASW) in England. An urbanisation index (UI) for each ward was calculated as the ratio of built space to to open space where:

i) 'built space' was calculated as the sum of the area of Domestic buildings, Domestic gardens, Non-domestic building, Roads and Rail; and
ii) 'open space' was calculated as the sum of the area of Paths, Greenspace and Water.

The natural logarithm of the UI was divided into three categories of Urban, Semi-Urban, and Rural. Each category was tested on As and Pb concentrations in topsoils from urban and rural samples from the BGS G-BASE project and the National Soils Inventory (XRFS) data set and Benzo [a] pyrene (BaP) from the English Environment Agency UK Soil and Herbage Sample data.

For As, there appears to be no observable trend in the As concentration between the rural and urban UI distributions, where all three categories of urbanisation have very similar data distributions. This suggests that, compared to natural sources, As in soils in England has a minimal contribution from diffuse pollution.

Lead shows a trend of increasing concentrations from the rural to urban categories. There are a number of high outliers in the rural and semi-urban categories which are likely to come from natural Pb sources in the Derbyshire orefield which occur in rural and urban locations. This confirms literature findings that the Pb content of soils has a significant diffuse pollution contribution.

For BaP the data distributions show very similar trends to Pb with increasing concentrations in BaP from rural to urban locations. This confirms literature findings that BaP is mostly derived from anthropogenic inputs and its concentration in soils is controlled by diffuse pollution.