



The assessment of point-source and diffuse soil metal pollution in Swansea (Wales, UK) using robust geostatistical methods.

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The urban area of Swansea was a centre of metal processing and production from the 16th until the 20th century and was subject to a substantial amount of diffuse atmospheric and point-source metal pollution. We map the concentrations of four heavy metals across the urban region based upon a soil geochemical survey undertaken by the British Geological Survey in the summer of 1994 covering an area of 93 km² at a density of 4 samples per km². The non-aligned sampling grid yielded a total of 373 samples.

Analyses of these samples by X-ray fluorescence spectrometry revealed that throughout the urban area the concentrations of As, Cu, Pb and Sn were greater than the ambient background concentrations. Several hotspots of each of these heavy metals were observed at former industrial sites. These hotspots hinder the mapping of these metal concentrations by conventional geostatistical methods in two ways. Firstly when models of spatial variation are fitted to the data the hotspots lead to the variance of the metal concentrations being over-estimated. This can in turn lead to details within our maps being smoothed out. Secondly conventional interpolation techniques such as kriging exaggerate the size of the hotspots.

Therefore the components of metal concentrations due to point-source and diffuse pollution were mapped separately by robust geostatistical methods. We assume that the dominant pattern of spatial variation of metal concentrations across the urban region results from diffuse pollution whereas the hotspots are statistical outliers. Robust models of spatial variation were used to represent the diffuse component of pollution. The parameters of these models are not unduly influenced by the outliers. The diffuse pollution was mapped by robust median kriging. This method is able to identify and truncate the outliers. Statistical validation confirmed the appropriateness of the model of the spatial variation of metal concentrations due to diffuse pollution. Historical records of industrial activity were used to determine potential sources of contamination at the sites where outliers were identified.