



Employing a portable X-Ray fluorescence (P-XRF) analyser and GIS to identify and map heavy metal pollution in soils of a traditional bonfire site

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Soils in the vicinity of bonfires are recipients of metal contaminants from burning of metal-containing materials. In order to better understand the impacts of bonfires on soils, a total of 218 surface soil samples were collected from a traditional bonfire site in Galway City, Ireland. Concentrations of Cu, Pb and Zn were determined using a portable X-ray Fluorescence (P-XRF) analyser. Strong variations were observed for these metals, and several samples contained elevated Zn concentrations which exceeded the intervention threshold of the Dutch criteria (720 mg kg⁻¹). Spatial clusters and spatial outliers were detected using the local Moran's I index and were mapped using GIS. Two clear high value spatial clusters could be observed on the upper left side and centre part of the study area for Cu, Pb and Zn. Results of variogram analyses showed high nugget-sill-ratios for Cu, Pb and Zn, indicating strong spatial variation over short distances which could be resulted from anthropogenic activities. The spatial interpolation method of ordinary kriging was applied to produce the spatial interpolation maps for Cu, Pb and Zn, and the areas with elevated concentrations were in line with historical locations of the bonfires. The hazard maps showed small parts of the study area with Zn concentrations exceeding the Dutch intervention values. In order to prevent further contamination from bonfires, it is advised that tyres and other metal-containing wastes should not be burnt. The results in this study provide useful information for management of bonfires.