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Suitability of field portable XRF for the study of contaminated peat soils

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Upland peat soils in close proximity to urban and industrial areas can be contaminated with - and act as sinks for - high concentrations of atmospherically deposited lead. Erosion of these soils has the potential to release lead to surface waters. Lead storage is not uniform across peat surfaces and significant within-site spatial variability has previously been found. In heavily degraded areas this is further complicated by gullying and the removal of surface material from bare peat flats. Quantifying lead concentrations across the surface of actively eroding peatlands is vital in order to understand lead storage and release in such systems. Field portable x-ray fluorescence (FPXRF) continues to gain acceptance in the study of metal contaminated soil; however, FPXRF has not been used to conduct field surveys of contaminated peat soils due to their high moisture content. FPXRF analysers allow a large number of samples to be processed in a relatively short time giving a high level of detail with little disturbance to the surrounding area. They also offer significant advantages over off-site laboratory analysis in terms of on-site decision making and faster turn-around of results.

This study compares lead concentration data obtained *in situ* using a handheld *Niton XL3t 900* X-Ray Fluorescence analyser with data derived from *ex situ* lab based analyses. *In situ* measurements were acquired across degraded and intact peatland sites in the Peak District, southern Pennines, UK. Field samples were then dried, homogenised and analysed again using the FPXRF before subsequent acid digestion and analysis using inductively coupled plasma atomic emission spectroscopy (ICP-OES). The moisture content of the samples was also determined and used to normalise the *in situ* field measurements.

A good relationship was found between *in situ* and *ex situ* lead concentration data. Linear regression analysis yielded r^2 values of 0.80 (*in situ* XRF vs. ICP-OES) and 0.82 (*in situ* XRF vs. *ex situ* XRF). These are improved slightly when *in situ* concentrations are normalised for moisture content. This study reveals that FPXRF can provide an accurate, rapid and cost-effective means of assessing surface lead content in contaminated peatland environments.