The influence of urbanisation on forest soils: Comparing variability and mobility of potentially toxic elements and carbon sequestration between urban regions in Scotland and Bulgaria

ANDREW HURSTHOUSE[1]*, VANYA DOICHINOVA[2] AND MIGLENA ZHIYANSKI[2]

[1]School of Science, University of the West of Scotland, Paisley, PA1 2BE, UK (*andrew.hursthouse@uws.ac.uk)
[2]Forest Research Institute, Bulgarian Academy of Sciences, 132 "Kliment Ohridski" Blvd., 1756 Sofia, Bulgaria (doichinova@abv.bg; zhiyanski@abv.bg)

The process of urbanization creates unique urban ecosystems and urbanized soils. Due to high pollution load and the dynamic effect of climate change in the urban environment, green infrastructure comes under increasing stress. The great potential is for urban forest areas to offer a significant contribution in mitigation of CO_2 at a small scale, but little is known about the interaction with urban soils, increasingly recognized as a sink for inputs of urban pollutants. Our study looked at a number of forest soil sites along rural-urban gradiets in Glasgow, Scotland and the Sofia Region, Bulgaria.

We compared soil properties with carbon stocks, nutrient availability and potentially toxic element loads. In urban soils of Sofia carbon stocks varied between 80 - 125 tC ha^{-1} and for Glasgow 76 - 120 tC ha^{-1}, with non-urbanized control sites: 53 - 103 tC ha^{-1} for the Sofia region. The tree carbon stock, was higher in non-urbanized sites, because of higher tree density in these plots. The results for aboveground biomass carbon stock in urban sites varied between 34.5 - 61.7 tC.ha^{-1} for Sofia and 45.2 - 60.8 tC.ha^{-1} for Glasgow and in Non-Urban sites: 33.9 - 67.5 tC.ha^{-1}, and 57.3 tC.ha^{-1} respectively.

We obtained strong correlations between mobile forms of Cu, Zn, Pb, Cd in urban soils and a number of soil parameters (pH, CEC and texture). The mobility related to soil pH (and OM for Cu) agreeing with other work in the cities. The most mobile soil fraction was found for Cd (33%). The assessment of health status of oaks tree vegetation based on indices defoliation of crown and changes in color do not correlate significantly with the bioavailable concentration of PTEs in the soils. Carbon sequestraton relates strongly to management activity and the influence of PTE content is obscured.

Redox and nutrient cycling in a late Mesoproterozoic sea

K.F. HUSBAND[1,2]*, S.W. POULTON[1], R. GUILBAUD[1], A.D. ROONEY[3] AND D. SELBY[4]

[1]Sch. Earth & Env., Uni. of Leeds, Leeds, LS2 9JT, UK (*correspondence: K.Husband@leeds.ac.uk)
[2]Sch. Civil Eng. & Geosci., Newcastle Uni., Newcastle upon Tyne, NE1 7RU, UK
[3]Dept. Earth & Planet. Sci., Harvard Uni., Cambridge MA 02138, USA
[4]Dept. Earth Sci., Uni. of Durham, Durham, DH1 3LE, UK

A growing body of evidence suggests that, during the so-called 'boring billion' (~1.8-0.8 Ga), the global ocean was characterised by widespread euxinia along productive continental margins, with deeper waters that remained ferruginous. In detail, however, evidence for euxinic conditions in continental margin settings is extremely scarce in the early Neoproterozoic (~1.0-0.75 Ga), with most evidence instead suggesting an expansion of ferruginous conditions. In addition, little is known about the detailed nature of ocean chemistry in the late Mesoproterozoic, prior to this apparent change in global ocean chemistry. Ocean redox conditions potentially exert a strong control on nutrient cycling, thus influencing organic carbon production and burial, and, in turn, environmental oxygen levels. However, the lack of detailed studies on late Mesoproterozoic successions means that little is known about redox-driven nutrient feedbacks at this time, and hence controls on environmental conditions towards the end of the 'boring billion' remain poorly understood.

Here, we present an integrated study of Fe-S-C systematics and P cycling in the 1.1 Ga Taoudeni Basin of Mauritania. Earlier in the succession, we find that euxinia was prevalent in mid-depth waters, with deeper waters being ferruginous. However, there is less evidence for euxinia further up the succession and instead ferruginous conditions became more widespread. Ferruginous conditions throughout the succession are commonly characterized by enhanced organic C burial, suggesting that the development of euxinic conditions was not simply driven by organic C availability. To provide further insight, we utilize P speciation and S isotope data, which together shed new light on environmental condtions during this crucial interval that marks the final stages of several hundred million years of apparent environmental stasis.

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