Lichen biomonitoring and GIS analysis of atmospheric pollution and air quality in Manchester, UK

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Project Aim

Urban populations are increasingly exposed to airborne pollutants, which can contribute to lung and cardiovascular diseases, leading to approximately 40,000 premature deaths in the UK [1].

Lichen biomonitoring of atmospheric chemical pollutants is applied to the city of Manchester, UK. This approach seeks to develop a high spatial resolution model of urban air pollution and air quality. Epiphytic lichens, i.e. X*anthoria parietina* and *Physcia* spp., were sampled from different 'Urban Morphology Types (UMTs)' and measured to quantify atmospheric pollutant concentrations, via total N (by CN analyser), metals (by ICP-OES and ICP-MS) and PAHs (by GC-MS).

Spatial variability of airborne pollution levels, from lichen-derived pollutant datasets, then are used to develop a predictive geostatistical model for Manchester.

Preliminary Results

Lichen nitrogen content and metal (Al, Cd, As, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn) concentrations document spatial variability of atmospheric pollutants across the city of Manchester. *X. parietina* and *Physcia* spp. wt% nitrogen data confirm an influence of airborne nitrogen compounds (e.g. NOx) on lichen nitrogen contents, especially close to main roads. Metal concentrations exhibit spatial variability within (and between) UMTs and higher concentrations (i.e. Cu, Fe, Mn, Ni, Pb and Zn) tend to be associated with particular features, e.g. proximity to roads and traffic-related emissions.

Further sampling and analysis of lichen samples (i.e. for PAHs, ammonium and nitrate, as well as stable-isotope ratios) and passive air sampling devices (NO_2: NOx diffusion tubes, PAHs: PUF disks) are planned to ground-truth lichen derived pollutant loadings and to develop an explicit GIS-based spatial pollution model, including influencing factors, e.g. land-use types, traffic volume and building heights.

[1] RCP (2016). Every breath we take: the lifelong impact of air pollution. Report of a working party.