MOSS AS BIO-INDICATORS OF HUMAN EXPOSURE TO POLYCYCLIC AROMATIC HYDROCARBONS IN PORTLAND, OR

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Abstract—Polycyclic aromatic hydrocarbons (PAHs) are a class of air pollutants linked to a wide range of adverse health outcomes, including asthma, cancers, cardiovascular disease, and fetal growth impairment. PAHs are emitted by combustion of organic matter (e.g. fossil fuels, plant biomass) and can accumulate in plant and animal tissues over time. Compared to criteria pollutants, such as O_3 or NO_2, less is known about PAHs in air inhaled by the general population because PAH monitoring is more technically challenging and costly (in Portland, for example, PAHs are measured by only one monitor). One cost-effective alternative is including bio-indicators in urban forest inventories to estimate how human exposure to PAHs varies across an area. Bio-indicators are less costly to collect and can integrate air pollutants over a long period of time, making them well suited to measuring chronic low-levels of air pollution that aren't detected by conventional air-quality monitors. We collected 347 moss samples (*Orthotrichum spp.*) across Portland, Oregon in December 2013 and tested each sample for the 16 PAHs identified by EPA as priority pollutants. For pyrene, benzo[a]pyrene, and naphthalene, we estimated regression models of moss PAH controlling for road density, vegetation, elevation, residential wood combustion, and weather that accounted for spatial autocorrelation among residuals. In addition, we used Bayesian multiple imputation to address non-detects. Road density and secondary wood burning (fireplaces) were associated with higher PAH levels, whereas tree cover and grass-and-shrubs were associated with lower PAH levels. Vegetation cover appears to be at least as important as road density in determining PAH concentrations. Other factors associated with PAHs in moss include elevation, daily temperature, humidity, and whether the sampled tree was in a tree genus with narrow crowns. We used the regression models to make fine-scaled maps of PAH concentrations across Portland.

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