

Urban brownfields present an opportunity to study the functioning of degraded ecosystems. We investigated the soils of Liberty State Park in Jersey City, New Jersey, which once supported a major rail yard and port facility with docks for shipping cargo to New York City. ICP-MS and pyrolysis-GC-MS studies were used to show that our study site is contaminated with heavy metals and organic contaminants, including polycyclic aromatic hydrocarbons. We used fluorescence spectroscopy to measure soil enzymatic function at multiple locations within the brownfield and found the following types of sites: 1.) hotspots with high heavy metal concentrations and high extracellular soil enzymatic activity; 2.) an industrial barren with barely detectable enzymatic function, dormant microbial life, and a “metal cap” on the soil surface; and 3.) planted sites with moderate metal concentrations and enzymatic function. We conducted cross-inoculation experiments, analyzed the microbial community composition using high-throughput sequencing, and added plants and root exudates to our soils. Our data together support the following conclusions: 1.) Soil microbial community functioning can be high and diverse in spite of high heavy metal loads; 2.) Abiotic rather than microbial factors limit microbial community functioning at Liberty State Park; and 3.) Dormant and abiotically limited microbes at barren sites can be revitalized by redistribution of metals to allow plant growth or by addition of artificial root exudates. In conclusion, contaminated, urban and post-industrial sites can have high functional diversity. Moreover, soil function at Liberty State Park can be modulated through perturbing soil abiotic conditions. These findings may be relevant to other contaminated soils located in or near urban or post-industrial centers globally and offer insights into potential strategies for soil revitalization and contamination management.

