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Soil contamination by heavy metals in the city: a case study of Petach-Tikva, Israel

Pariente Sarah, Helena Zhevelev , and Orna Ido-Lichtman

Laboratory of Geomorphology and Soil, Department of Geography and Environment, Bar-Ilan University, Ramat-Gan 52900, Israel (Sarah.Pariente@biu.ac.il)

Heavy metals are among the most important pollutants which are affected by human activities. These pollutants impact both the natural and urban ecosystems. In the latter they are associated with the human health of the residents.
The general aim of the study is to investigate the spatial variability of soil heavy metals in the city of Petach-Tikva. We asked if and to what extent the urban structure determines the spatial pattern of soil contamination. Urban structure in this study refers to the morphology of neighborhoods (density and height of buildings), the industrial area location and the roads system.
It includes three main and industrial areas in the margins of the city. The city is also subjected to heavy traffic and contains different types of neighborhood morphology.
To promote the above aim a preliminary study was conducted in 2016. Soil sampling was carried out along a strip, running from the Northwest industrial region of the city to the residential region in the center. Soil samples were randomly taken, from 0-5 cm, from industrial, near high traffic roads and between buildings areas. Each was analyzed for three heavy metals (Pb, Zn, Cu) commonly associated with industry and traffic emissions.
Primary results show that for all the city studied areas the range values of Cu Zn and Pb concentrations were 1800, 1270 and 150 ppm, respectively, meaning high spatial variability of the heavy metals. In the soil of the industrial area the averages and the maximum values of Pb, Zn, and Cu concentrations were 76, 353 and 500 ppm and 153, 1286 and 1847 ppm, respectively. In the soil between buildings the averages were 20, 78 and 13 ppm and the maximum values reached 38, 165 and 37 ppm for Pb, Zn, and Cu, respectively. In the soil near roads the averages were 39, 120 and 214 ppm, and the maximum values were 153, 477 and 74 ppm for Pb, Zn, and Cu, respectively. These results indicate that the city industry has the greatest effect on soil pollution. Within the city neighborhoods the traffic effect on soil contamination was more pronounced in areas close to the roads with respect to the areas far from them.
Some of soil sampling points showed heavy metals contents, which were higher than the values permitted by the guidelines of the Israeli EPM. These hot spots can be attributed to combined contamination factors or to high intensity of a single human activity or to low soil sheltering. The preliminary study leads to the conclusion that under the industry and traffic that prevailed in the city soil contamination increases in the vicinity of the residential area. The effect of neighborhood morphology is still under analysis.