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The Impact of Urban Farming Practices on Heavy Metals in Newark Soils: The city of Newark has an extensive network of urban farms and gardens that improve access to fresh foods in Newark's food deserts. However, urban agriculture is challenging as Newark soils are impaired by contaminants from anthropogenic sources, including heavy metals such as lead (Pb). Metal contaminated soils have low fertility as metal toxicity can impede soil biological activity, altering the accumulation and breakdown of organic matter. Farming these soils also exposes humans to metals through ingestion or inhalation of soil dust and transfer to crops. In addition to total metal concentrations, metal speciation and bioavailability, as influenced by physical and chemical soil properties, can dictate metal transfer pathways, toxicity and health effects. The response to farming in Newark's contaminated, low fertility soils is implementation of Natural Resources Conservation Service (NRCS) practice standards, including raised beds and composting, which can address metal concentrations and organic matter content in soils. The goal of this project is to understand the impact of raised beds and compost amendments on the concentration, speciation and bioavailability of metals in urban farm soils in Newark.



Figure 1: Field and laboratory research (a) field soil analysis for heavy metals using portable X-ray fluorescence (pXRF); (b) collecting samples in the field; (c) sieving soils in the lab to determine particle size and to prepare for further analysis (d) laboratory analysis of extracted metals using inductively-coupled plasma optical emission spectroscopy (ICP-OES).

The research will involve both field and laboratory experiments (Fig. 1). Field work will take place on an urban farm and will include analysis of undisturbed Newark soil, soils in raised beds and compost for elemental and heavy metal concentrations using pXRF and portable laser induced breakdown spectroscopy instruments. Select soils and compost samples, with a range of metal concentrations, will be sampled for further analysis. In the lab, samples will be prepared and characterized for physical and chemical properties such as particle size, pH, carbon content, and mineralogy by X-ray diffraction. To determine the metal speciation and the bioavailability to crops and organisms, samples will be reacted to extract metals bound to different soil/chemical fractions and metal concentrations in extractants analyzed by ICP-OES. To understand the impact of compost amendments on metal and organic content, soil and compost samples will be mixed at different ratios and incubated over time. Amended samples will be analyzed for total metal concentration, carbon content, pH and other chemical properties. Metal extraction experiments will be conducted to determine the effect of compost additions on metal speciation and bioavailability relative to unamended raised bed and Newark and soils. Local and regional impact includes sharing results with Newark farmers and the NRCS New Jersey Office to provide scientific evidence for the role of recommended urban farming practices in mitigating the harmful effects of heavy metals in urban agriculture soils.