Soils in GI systems: sink for runoff contaminants and functional changes

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Green infrastructure (GI) refers to environmental design features or engineered systems in an interconnected natural and urban space that provide multifunctional ecosystem services. Soils in GI systems provide three fundamental functions: infiltrate stormwater runoff, retain enough moisture to support plant growth, and filter pollutants in the urban runoff. Soil is known to be an effective natural filter, and pollutants bound to particulates can be very effectively removed by soil filtration. Soil texture, organic content, and other properties play critical roles in the effectiveness of pollutant removals. A study of an engineered stormwater management system at a metals recycling site showed that metals/metalloids were effectively retained in the mulched sandy topsoil. There was little evidence of metals/metalloids of downward migration in the soil column or in the groundwater. The rate of pollutant accumulation in topsoil can be affected by many factors, and the pollutants can affect the biogeochemical functions of soil. In another pilot study in the Jamaica Bay Watershed (NYC), we found that GIs with larger surface area had significantly lower Total Petroleum Hydrocarbon (TPH), Pb, and Zn. Microbial biomass and activity were positively correlated with organic content, total nitrogen, pH, Moisture Content, TPH, and Watershed Area Ratio. Denitrification potential, microbial biomass carbon and nitrogen contents varies depending on the types of GI designs. Understanding these functional differences and changes is important to the long term sustainability of such systems, and their ability to continuously remove pollutants (e.g., metals, TPH, nutrients), support plant growth, while maintaining sufficient stormwater capturing efficiency.