Data Driven Approach to Enhance Street Sweeping in Urban Areas

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Abstract

This study aims to develop a data driven approach to enhance street sweeping in urban areas. Street sweeping can be an effective nonstructural best management practice to reduce stormwater runoff pollution from impairing nearby waterbodies. For this experiment, street solid and stormwater samples are collected from different road segments in Warwick, RI. The samples are analyzed for concentrations in heavy metals (zinc, copper, lead, etc.), nutrients (phosphorus and nitrogen), polycyclic aromatic hydrocarbons, and microplastics. Using GIS analysis, the roads are characterized by their surrounding land use, impervious surface area, canopy coverage, building density, and road quality. These metrics are used to evaluate trends in pollutant accumulation. A road prioritization model is used to calculate priority scores to determine the location and frequency of street sweeping, depending on these GIS metrics. The road prioritization model is developed for each sweeping season, spring summer, and fall. A python and GIS based tool, SSWEEPR, is used to simulate pollutant accumulation, washoff, and removal due to street sweeping across different scenarios to evaluate the reduction and transport of pollutants. Additionally, a rainfall-runoff model (SWMM) is used to simulate the transport of pollutants through the urban drainage network. These analyses all support decision making which will be used to determine the location and frequency of street sweeping events. Lastly, an LCA will be conducted to evaluate the environmental impacts of the enhance street sweeping program.

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