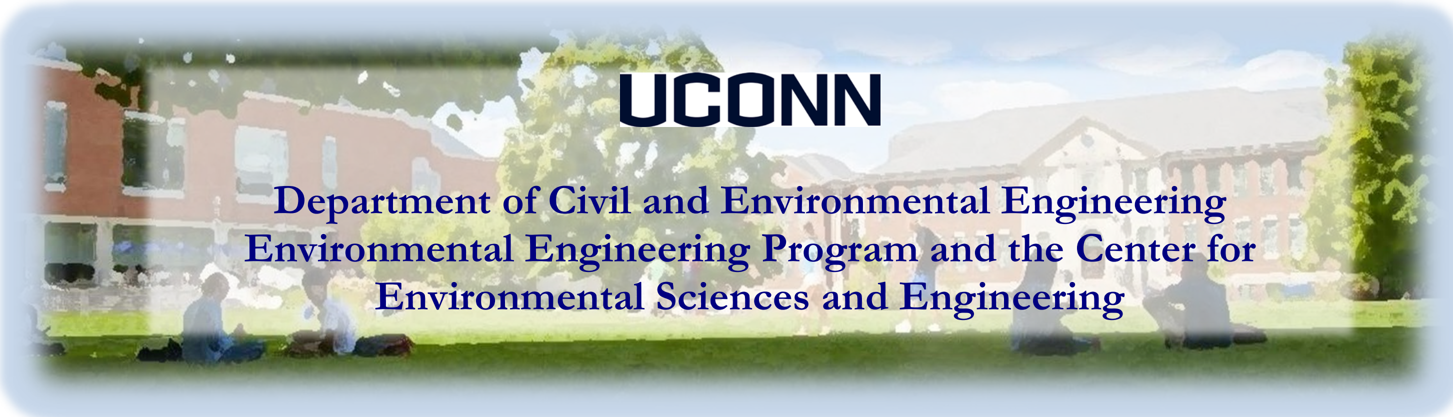

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The Shifting Landscape of Urban Soil Health: What Is It and How Do We Evaluate It?

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Abstract: Urban land reuse often involves the utilization of vacant sites for the purpose of residential development, public parks and playgrounds, and urban agriculture. Urban agriculture is on the rise in cities across the world as a promising sustainable practice for communities to have access to healthy and affordable produce by reducing the energy costs of food production and distribution, and while raised beds are often used in community gardens to ensure that soil quality meets proper standards, the use of existing urban soils is desired for economic and sustainability purposes. Urban soils are often impacted by past practices such as the use of contaminated fill materials, accumulation of atmospheric pollutants through deposition, or other waste. Therefore, it is important to test these urban soils for various parameters to limit the human exposure to potential contaminants, such as trace metals.

The main objective of the current study was to use seven vacant lots in Hartford, CT that are planned for community reuse to develop a methodology to properly sample and test soils for metal contaminants using in-situ screening methods to inform urban soil management decisions. In-situ measurements of metals were taken with a pXRF instrument, and additional sample preparation and pXRF measurements were performed in the laboratory, while XRF analyses were also compared with acid digestion and ICP-MS measurements. Additionally, inverse distance weighted geospatial interpolation of in-situ pXRF determined lead measurements was used to compare various soil sampling grid resolutions to determine the minimum sampling density that can be used to maintain detection of pollution hotspots while limiting the labor of the sampling process. Finally, the effect on urban soil management of a recent USEPA soil policy amendment to the regulatory threshold for lead is explored.

Integrating Physics Based WRF Atmospheric Variables and Machine Learning Algorithms to Predict Snowfall Accumulation in Northeast United States

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Abstract: Accurate snowfall prediction is crucial for enhancing preparedness and resilience in the Northeast United States during winter weather events. This study introduced a novel approach that integrates Machine Learning (ML) models with atmospheric variables from the Weather Research and Forecasting (WRF) model to improve snowfall forecasts in the region. The significance lies in bridging the gap between physics-based Numerical Weather Prediction (NWP) models and the versatility of ML models, offering a promising advancement in winter storm predictions. Atmospheric variables related to 32 winter storms simulated by WRF, were used to feed Random Forest (RF) and Extreme Gradient Boosting (XGBoost) algorithms to predict 24 h accumulations of snowfall by using the National Snowfall Analysis (NSA) product as reference. The comprehensive results revealed that the integrated approach provided more accurate snowfall prediction than WRF and Air Force Weather Agency (AFWA) diagnostic. The WRF/XGBoost reduced the RMSE and CRMSE by 10.34% and 11.01%, whereas WRF/RF reduced these values by 9.72% and 10.26%, respectively, compared to WRF/AFWA. Similarly, WRF/XGBoost and WRF/RF increased the correlation coefficient by 12% and 11%. The most important variables in both ML algorithms were liquid water equivalent precipitation (LWE), snow ratio, wet-bulb temperature, temperature, and humidity at different heights, pressure tendency and wind speed, validating their ability to discern crucial factors influencing snowfall. Specific cases highlight the integrated approach's effectiveness in addressing challenges faced by traditional diagnostics, including LWE overestimation and warm temperature bias. However, limitations emerge in capturing storms characterized by anomalous atmospheric conditions and high-end snowfall values, indicating areas for refinement to accommodate diverse storm characteristics. By highlighting strengths and acknowledging limitations, this integrated approach holds the potential for improved snowfall prediction for future storms in the region compared to the traditional approach.