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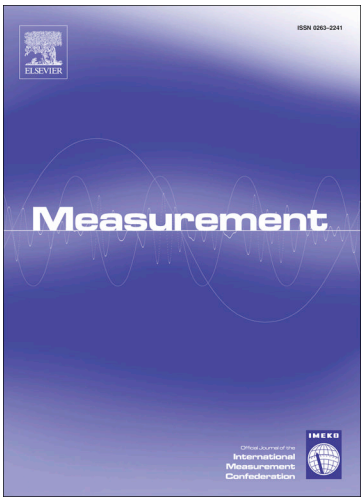

A New Computational Approach for Estimation of Wilting Point for Green Infrastructure

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A New Computational Approach for Estimation of Wilting Point for Green Infrastructure

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Abstract

Wilting point is an important parameter indicating the inhibition of plant transpiration processes, which is essential for green infrastructure. Generalization of wilting point is very essential for analyzing the performance of even green infrastructure (green roof, biofiltration units) and ecological infrastructure (wetlands). Wilting point of various species is known to be affected by the factors such as soil clay content, soil organic matter, slope of soil water characteristic curve at inflection point (i.e., s index) and fractal dimension. Therefore, its practical usefulness forms the strong basis in developing the model that quantify wilting point with respects to the deterministic factors. This study proposes the wilting point model development task based on optimization approach of Genetic programming (GP) with respect to the input variables (soil clay content, soil organic matter, s-index and fractal dimension) for various type of soils. The GP model developed is further investigated by sensitivity and parametric analysis to discover the relationships between wilting point and input variables and the dominant inputs. Based on newly developed model, it was found that wilting point increases with fractal dimension while behaves highly non-linear with respect to clay and organic content. The combined effect of the clay and organic content was found to greatly influence the wilting point. It implies that wilting point should not be generalized as usually done in literature.

Keywords: Wilting point; soil fractal dimension; s index; clay content; organic matter; evolutionary algorithms

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