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Estimation of Soil Organic Carbon in a Small-Scale Loessial Hillslope Using Terrain Derivatives of Northern IranSedigheh

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ABSTRACT

Aims Soil organic carbon (SOC) is contemplated as a crucial proxy to manage soil quality, conserve natural resources, monitoring CO_2 and preventing soil erosion within the landscape, regional, and global scale. Therefore, the main aims of this study were to (1) determine the impact of terrain derivatives on the SOC distribution and (2) compare the different algorithms of topographic wetness index (TWI) calculation for SOC estimation in a small-scale loess hillslope of Toshan area, Golestan province, Iran. (3) Comparison between multiple linear regression (MLR) and artificial neural networks (ANN) methods for SOC prediction.

Materials & Methods total of 135 soil samples were taken in different slope positions, i.e., shoulder (SH), backslope (BS), footslope (FS), and toeslope (TS). Primary and secondary terrain derivatives were calculated using digital elevation model (DEM) with a spatial resolution of 10 m × 10 m. To SOC estimation (dependent variable) was applied two models, i.e., MLR and ANN with terrain derivatives as the independent variables.

Findings The results showed significant differences using Duncan's test in where TS position had the higher mean value of SOC (25.90 g kg−1) compared to SH (5.00 g kg−1) and BS (12.70 g kg−1) positions. The present study also revealed which SOC was more correlated with TWIMFD (Multiple-Flow-Direction) and TWIBFD (Biflow-Direction) than TWISFD (Single Flow Direction). The MLR and ANN models were validated by additional samples (25 points) that can be explain 65% and 76% of the total variability of SOC, respectively, in the study area.

Conclusion These results indicated that the use of terrain derivatives is a beneficial method for SOC estimation. In general, an accurate understanding of TWIMFD is needed to better estimate SOC to evaluate soil and ecosystem related effects on global warming of as this hilly region at a larger scale in a future study.

Keywords Artificial Neural Networks; Different Flow Direction; Loess; Multiple Linear Regression

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