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Estimation of soil organic carbon in agricultural fields: A remote sensing approach

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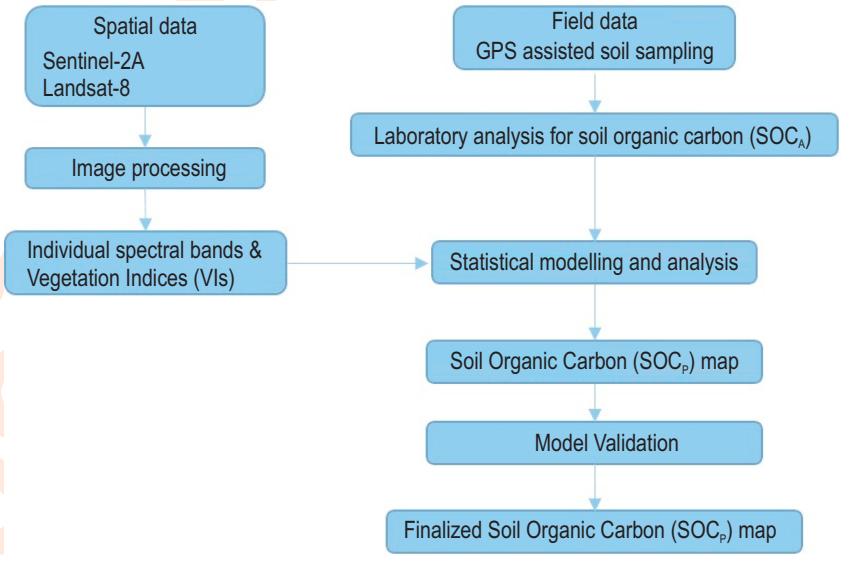
Abstract

Aim: In view of the importance of Soil Organic Carbon (SOC) in agricultural management, a study was conducted to develop a digital SOC map using remotely sensed spectral indices. The present study was conducted on the Tawdeehiya Farms, located in the central region of Saudi Arabia between Al-Kharj and Haradh cities.

Methodology: Landsat-8 (L8) and Sentinel-2 (S2A) satellite images were used for the characterization of SOC stocks in the topsoil layer (0-10 cm) of the experimental fields. Soil samples were randomly collected from six (50 ha each) agricultural fields and analyzed in the laboratory for SOC (SOC_A) following Walkley and Black method. While, vegetation indices (VI), such as the Normalized Difference Vegetation Index (NDVI), NDVIRedEdge, Enhanced Vegetation Index (EVI), Bare Soil Index (BSI), and Reduced Simple Ratio (RSR) were computed and subsequently used for the development of SOC prediction models.



Results: Univariate linear regression technique was employed for the recognition of a suitable band/VI for SOC (SOC_P) mapping. The SWIR-1 band of both L8 (R^2 = 0.86) and S2A (R2 = 0.77) data was promising for predicting SOC with 16% (S2A) and 18% (L8) of BIAS.

Interpretation: The NDVI and BSI (for L8 data) and BSI and RSR (for S2A data) were found most suitable VI in the prediction of SOC. The R^2 values of linear regression models were 0.68 (BSI) and 0.78 (RSR), indicating that nearly 68% and 78% of the SOC could be predicted through L8 and S2A datasets, respectively.

Key words: Mapping, Satellite imagery, Soil organic carbon, Univariate analysis, Vegetation indices

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