

Application of Minimal Data Sets for Quantitative Assessment and Investigation of Spatial Autocorrelation of Soil Quality in Southwestern Lands of Urmia Plain

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(Received: June 10-2023 ; Accepted: August 13-2023)

Abstract

Soil quality is one of the most crucial factors determining crop productivity and production stability. The soil's physical, chemical, biological, and ecological characteristics affect its quality. Numerous researchers have concentrated the evaluation on a small number of soil quality indicators because measuring all soil quality indicators would be time-consuming and expensive. This study looked at the spatial autocorrelation of soil quality in the southwest areas of the Urmia Plain to establish the minimal data set for quantitative assessment. To accomplish this, 120 composite soil samples were collected from a depth of 0 to 60 cm, and the soil quality index was then calculated using the IQI method in 4 modes: Total-Linear (IQIwL-TDS), Total-Nonlinear (IQIwNL-TDS), Minimum-Linear (IQIwL-MDS), and Minimum nonlinearity (IQIwNL-MDS). 22 physical and chemical characteristics were used to choose the data set. The characteristics of sand percentage, sodium absorption ratio, cation exchange capacity, Available phosphorus, active calcium carbonate, and nickel concentration were chosen as the minimum data set (MDS) using the decomposition method into principal components. The linear IQIMDS mode produced the greatest soil quality index result, whereas the non-linear IQIMDS mode produced the lowest. The non-linear mode of the IQI index has a greater correlation coefficient ($R^2=0.85$) than the linear mode of the IQI index ($R^2=0.73$), according to an analysis of the linear and non-linear correlation coefficient between the soil quality index with the total category and minimum data. The findings of computing the global Moran's index for study sets of IQI soil quality index data revealed that the soil quality data are not independent of each other and are spatially autocorrelated, distributed in clusters, and have spatial autocorrelation. Getis-ord GI statistics indicated that the eastern and southeastern parts of the research region comprise clusters with poor soil quality, salt marshes produced by Lake Urmia's drying up, and surrounding arid plains.

Keywords: Physical and chemical characteristics, IQIw, PCA, Global Moran Index, Getis-ord GI

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