

Development of a Spatial Hydrologic Soil Map Using Spectral Reflectance Band Recognition and a Multiple-Output Artificial Neural Network Model

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Abstract

Soil type is important in any civil engineering project. Thorough and comprehensive information on soils in both the spatial and temporal domains can assist in sustainable hydrological, environmental and agricultural development. Conventional soil sampling and laboratory analysis are generally time-consuming, costly and limited in their ability to retrieve the temporal and spatial variability, especially in large areas. Remote sensing is able to provide meaningful data, including soil properties, on several spatial scales using spectral reflectance. In this study, a multiple output artificial neural network model was integrated with geographic information system, remote sensing and survey data to determine the distributions of hydrologic soil groups in the Horan Valley in the Western Desert of Iraq. The model performance was evaluated using seven performance criteria along with the hydrologic soil groups developed by the United States Geological Survey (USGS). On the basis of the performance criteria, the model performed best for predicting the spatial distribution of clay soil, and the predicted soil types agreed well with the soil classifications of the USGS. Most of the samples were categorized as sandy loam, whereas one sample was categorized as loamy sand. The proposed method is reliable for predicting the hydrological soil groups in a study area.