Digital Soil Mapping Classes in the Oued Righ Region Using a Random Forest Model (Southeastern Algeria)

Helimi Samia[1-2], Hamdi-Aissa Baelhadj[2], Koull Naima[1]

[1] Scientific and Technical Research Center for Arid Areas (CRSTRA), Biophysical Environment Station, Touggourt, Algeria.
[2] Labo. Biogeochemistry of Desert Areas, Univ Kasdi Merbah Ouargla, Algeria.

Abstract

Digital Soil Mapping (DSM) using the Random Forest (RF) model within Google Earth Engine (GEE) is an approach that leverages the platform's computational power and the availability of satellite data to predict and map soil classes. This method can contribute significantly to the sustainable management and valorization of soil resources in arid regions. In this study, DSM was applied to predict soil classes in the Oued Righ region, located in the northern Sahara of Algeria. A total of 334 soil profiles, covering approximately 700,000 hectares, were classified according to the USDA Soil Taxonomy (2014) from the order to the subgroup level. Twenty environmental covariates with a spatial resolution of 30 meters, representing topography, vegetation, and parent material, were derived from three main sources: topographic attributes (DEM), remote sensing data (Landsat 8), and a geological map. To assess the accuracy and validate the spatial prediction results, Overall Accuracy (OA) and the Kappa index were used. Validation results showed that the OA for the Order, Suborder, Great Group, and Subgroup levels were 90%, 83.02%, 75%, and 65.30%, with corresponding Kappa values of 0.80, 0.73, 0.56, and 0.47, respectively. The Multiresolution Valley Bottom Flatness Index (MrVBF), slope, elevation, Normalized Difference Vegetation Index (NDVI), Gypsum Index (Gyps_indx), and Soil Surface Salinity Index (Sali_indx) were among the top covariates used for soil class prediction at all levels of the USDA Soil Taxonomy. In conclusion, the Random Forest machine learning algorithm shows considerable potential for mapping soil classes in arid regions.

Key Words: *Machine Learning, Digital Soil Mapping (DSM), GEE, Random Forest, Oued Righ.*