Prediction of Soil Organic Carbon across Different Land-use Patterns: A Neural Network Approach

ABSTRACT

Mathematical modeling has widely been used to predict soil organic carbon (SOC). However, there are characteristics of the models such as over simplification, ignorance of complex nonlinear interactions etc., which limit their use in accurately assessing the distribution of the C across the landscapes. Artificial neural network (ANN) modeling approach that provides a tool to solve complex problems related to larger data sets was therefore used here to predict SOC contents across different land use patterns in a study conducted in Sri Lanka. Selection of variables was made using a priori knowledge of the relationships between the variables. Thus, soils of the sites were sampled and analyzed for organic C by internal heat of dilution (Ci) and external heat of dilution (Ce), and the results were presented as grams per kilogram (g kg^{-1}). In addition, some landscape attributes and environmental parameters of the sites were also collected. The predictive performance of ANN was compared with multi-linear regression (MLR) models. The best ANN model predicted the measured Ci content with R^2 of 0.92. However, comparison of the two types of models indicated less bias and high accuracy of the ANN compared with MLR in predicting Ci, but the reverse for Ce. In order to better predict Ce, it is recommended to use other architectures of neural networks and training algorithms for improving predictive accuracy. The predictive capability of the ANN developed with easily available climatic and terrain data are of importance in predicting SOC with minimum cost, labor, and time.