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A Comparison of Selected Statistical Techniques to Model Soil Cation Exchange Capacity

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Cation exchange capacity (CEC) measures the soil's ability to hold positively charged ions and is an important indicator of soil quality (Khaledian et al., 2016). However, other soil properties are more commonly determined and reported, such as texture, pH, organic matter and biology. We attempted to predict CEC using different advanced statistical methods including monotone analysis of variance (MONANOVA), artificial neural networks (ANNs), principal components regressions (PCR), and particle swarm optimization (PSO) in order to compare the utility of these approaches and identify the best predictor. We analyzed 170 soil samples from four different nations (USA, Spain, Iran and Iraq) under three land uses (agriculture, pasture, and forest). Seventy percent of the samples (120 samples) were selected as the calibration set and the remaining 50 samples (30%) were used as the prediction set. The results indicated that the MONANOVA (R2= 0.82 and Root Mean Squared Error (RMSE) =6.32) and ANNs (R2= 0.82 and RMSE=5.53) were the best models to estimate CEC, PSO (R2= 0.80 and RMSE=5.54) and PCR (R2= 0.70 and RMSE=6.48) also worked well and the overall results were very similar to each other. Clay (positively correlated) and sand (negatively correlated) were the most influential variables for predicting CEC for the entire data set, while the most influential variables for the various countries and land uses were different and CEC was affected by different variables in different situations. Although the MANOVA and ANNs provided good predictions of the entire dataset, PSO gives a formula to estimate soil CEC using commonly tested soil properties. Therefore, PSO shows promise as a technique to estimate soil CEC. Establishing effective pedotransfer functions to predict CEC would be productive where there are limitations of time and money, and other commonly analyzed soil properties are available.

References

Khaledian, Y., Kiani, F., Ebrahimi, S., Brevik, E.C., Aitkenhead-Peterson, J. 2016. Assessment and monitoring of soil degradation during land use change using multivariate analysis. Land Degradation and Development. doi: 10.1002/ldr.2541.