EGU2020-974
https://doi.org/10.5194/egusphere-egu2020-974
EGU General Assembly 2020

VNIR spectroscopy for assessment of post-fire impacts on soil properties using linear and non-linear calibration methods

Iva Hrelja[1], Ivana Šestak[1], Aleksandra Perčin[1], Paulo Pereira[2], and Igor Bogunović[1]
[1]University of Zagreb, Faculty of Agriculture, Department of General Agronomy, Croatia (ihrelja@agr.hr)
[2]Environmental Management Center, Mykolas Romeris University, Vilnius, Lithuania

Fire is an important element of the ecosystems, nevertheless, high severity fires can have negative impacts on the ecosystems as consequence of the high temperatures reaches. High temperatures normally have detrimental impacts on soil properties. The objective of this work was to determine the relationship of spectral reflectance and soil pH, electrical conductivity (EC), carbonates ($CaCO_3$) and total carbon (TC) content after a medium to high severity wildfire occurred in Croatia using linear and nonlinear calibration models.

Soils were sampled 2 days after a medium to high severity wildfire in Zadar County, Croatia. A total of 120 soil samples (0-5 cm) were collected from three different treatments (n= 40 per treatment): control (C), mean severity (MS), high severity (HS). Soil pH, EC, $CaCO_3$ and TC content were determined using standard laboratory methods. Soil spectral measurements were carried out using a portable spectroradiometer (20 per treatment, 60 in total). Linear statistical model - partial least squares regression (PLSR) and non-linear - artificial neural network (ANN) were generated to estimate changes in soil pH, EC, $CaCO_3$ and TC content based on the original spectral reflectance and its first derivative in form of principal components (PC). One-way ANOVA revealed pH values were significantly different in all three treatments. EC, $CaCO_3$ and TC were significantly higher in HS plots compared with the other treatments.

Different wildfire severity indicated very collinear soil spectral response, but with certain variations of reflectance intensity. Control samples showed a higher reflectance than MS and HS samples. This is attributed to the low pH and TC content. Low reflectance of MS and HS samples could be explained by their increased pH and TC values. Soil pH was the only parameter that showed a high R^2 and low root mean squared error (RMSE) after Savitzky Golay smoothing and the first derivation. In PLSR model, strong to very strong correlation and low RMSE were obtained. ANN model also showed a high R^2 and lower RMSE for all properties except pH. Both models showed satisfactory results for prediction of the studied soil properties. ANN model predicted EC, $CaCO_3$, and TC better, while PLSR proved to be a better model for pH prediction.

Key words: soil reflectance, fire severity, principal components, partial least squares regression, neural networks

Acknowledgements

This work was supported by Croatian Science Foundation through the project "Soil erosion and degradation in Croatia" (UIP-2017-05-7834) (SEDCRO).

How to cite: Hrelja, I., Šestak, I., Perčin, A., Pereira, P., and Bogunović, I.: VNIR spectroscopy for assessment of post-fire impacts on soil properties using linear and non-linear calibration methods, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-974, https://doi.org/10.5194/egusphere-egu2020-974, 2019