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Visible-NIR spectroscopy as a cost-effective tool for soil organic carbon monitoring in the National Forest and Soil Inventory in Mexico

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Visible-NIR spectroscopy is a rapid and nondestructive analytical technique that correlates diffusely reflected near-infrared radiation with the chemical and physical properties of materials, and has been used for assessing soil qualities. The use of this technique to estimate the soil organic matter content (carbon content) has successfully been used in Mexico. The organic matter measurement by this method is an alternative to the use of automated methods which are not cost-effective. NIR spectroscopy has shown to be rapid, convenient, simple, accurate and able to analyze many constituents at the same time. Recently this method has been used to estimate soil carbon content in samples from the National Forest and Soils Inventory in Mexico.
Using NIR spectroscopy and an integration sphere has been possible to obtain reproducible spectrum of soil samples and also to lessen spectrum variations derived from particle size (2000-149 μm). Based on the spectrum footprints information it was possible to classify soils into five groups from very low to very high organic matter contents. Grouping soils according to spectral traits allows standing out differences and similarities among them. The use of NIR spectroscopy has been more than useful because we have been able to estimate the carbon content in more than 23 000 soil samples in a short period (near 400 samples per day). Using total C automated methods this would have been very difficulty, and expensive and it would have taken a very long time (50 samples per day). Currently we are working to establish strategies to improve the development of chemiometric models to predict soil organic carbon content in Mexican forests soils.