

Abstract

Testing the Use of Forest Soil $\delta^{13}\text{C}$ Shifts as a Post-Fire Index for Soil Burn Severity Estimation [†]

Irene Fernandez * and Ana Cabaneiro

IIAG-CSIC, Apdo. Correos 122, E-15780 Santiago de Compostela, Spain; acabaneiro@iiag.csic.es

* Correspondence: ifernandez@iiag.csic.es

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Abstract: Due to the increasing number and virulence of forest wildfires recently observed around the world, the establishment of a simple, accurate and reliable index that would correctly evaluate the fire effects on soil quality as a support for a suitable forest recovery management is becoming progressively more necessary. This objective is addressed here by using both $\delta^{13}\text{C}$ isotope ratio mass spectrometry and traditional solvent fractionation methods (widely used to assess soil biogenic components or humus fractions) to quantify the temperature-induced changes in soil chemical and isotopic composition. Soil samples from the upper 5 cm layer of two Cambisols developed over granite under pine forest in the NW of Spain were heated in an oven under controlled conditions to attain moderate or intense soil burn severity levels by using two different temperatures (220 °C or 350 °C). Biochemical changes induced by the heating process appreciably differed according to the intensity of the temperature applied. Multilinear regression modelling not only showed a significant relationship between soil C isotopic signature shifts ($\Delta_{\text{soil}} \delta^{13}\text{C}$) with temperature increases but also revealed other key outcomes: i.e., >96 or >81% of its total variance can be predicted by changes in lignin or non-humified organic matter, respectively. Indeed, $\Delta_{\text{soil}} \delta^{13}\text{C}$ explained by itself $\approx 60\%$ of thermal variance, pointing to the aptness of using ^{13}C shifts as a valid index for soil burn severity estimation in wildfires.

Keywords: forest wildfires intensity; edaphic thermal alteration; soil organic matter ^{13}C -isotopic signature



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