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Temporal variability in soil organic carbon in response to erosion in mountain agricultural landscapes

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Soil erosion leads to the loss of fertile topsoil, resulting in one of the principal soil degradation problems in agricultural landscapes worldwide. Soil redistribution processes affect the spatial and temporal variability of soil properties and nutrients, as soil organic carbon (SOC) which is linked to soil quality and soil functions. In the context of climate change mitigation as well as soil fertility and food security, there has been considerable interest in monitoring soil and carbon loss, especially in erosion-affected agricultural landscapes.

In this study, we attempt to evaluate the temporal variation of SOC and carbon fractions in a Mediterranean mountain agroecosystem. To this purpose, repeating soil sampling and carbon measurements within the same sites was undertaken in 2003 and in 2016. The sampling sites were located in agricultural areas where erosion or deposition preferably occurs based on soil redistribution rates obtained by using ¹³⁷Cs measurements. The content of soil organic carbon (SOC) and the active and stable SOC fractions, (ACF and SCF, respectively) contents were measured by the dry combustion method using LECO RC-612 equipment.

Although statistically significant differences between the two surveys were not found, the mean content of SOC, ACF and SCF were slightly lower in the survey taken in 2016 than the one in 2013. Repeated topsoil sampling (0-5 cm) after 13 years reveals SOC and ACF losses for almost all the agricultural soils selected in this research. It's important to highlight that the biggest differences between the two surveys are identified in the sites located in areas with steep slopes, while small variations occurred in the sites located in gentle slopes where deposition processes predominate. However, even if SCF losses were detected, especially in the erosive sites located in steep slopes, the content of SCF slightly increases for the second survey in sites located in depositional areas. To date, there have been few attempts to monitor soil carbon in Mediterranean soils, and this study represents a preliminary investigation that may be suitable for tracking absolute changes in SOC and carbon fractions in agricultural landscapes.