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Dynamics of organic carbon pools and microbial diversity over time in anthropogenic terraced soils of Southern Peru

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At worldwide level the relevance of anthropized soilscapes has progressively become of prominent importance. Such soilscapes are much diversified according to the multitude of human activities, such as agriculture and forestry (i.e. leveling and terracing, prolonged application of organic amendments, flooding, irrigation and drainage, land use change), which are able to affect the soil genesis and properties, determining a broad range of soil conditions. Although many processes related to long-term agricultural use have deeply influenced the soil properties over a few thousand years, the anthropogenic processes are relatively fast-acting as compared to the natural processes of soil formation, and over the last few years have marked out many areas of the world, also in developing countries.
The main objective of this study was to investigate the dynamics of organic carbon pools and the microbial diversity over time in anthropogenic terraced soils in a desert area of Southern Peru (Arequipa). Five sites were selected considering soils cultivated since 5 (P5), 15 (P15), 20 (P20), 35 (P35) and 65 (P65) years and sampled along the profile depth (0–20 cm; 20–40 cm layer). Soil and microbial parameters comprised by organic carbon pools, microbial respiration, microbial community physiological profile (CLPP) and genetic diversity (PCR-DGGE) were determined. The results showed that the highest C concentrations were reached after a long cultivation time (P65), at both depths. In this site Corg was mainly composed by chemically not extractable C, considered the most stabilized or recalcitrant fraction. The remaining extractable C fraction decreased with the depth and was mainly made up of highly mineralizable compounds. However, for the biological pools, soil respiration activity was very low in all samples and the microbial physiological profile suggested that the microbial metabolism is likely related to the amount and the quality of available Corg. The effects of agriculture are clearly distinguished from the prolonged cultivation between P5 and P35, inducing a gradual reduction of the bacterial diversity and its stabilization over time. In contrast the bacterial community structure after 65 years (0-20 cm) appeared to be significantly different from P35, suggesting that a new homeostatic condition has occurred likely due to agricultural management. The data showed that the human-induced transformations has affected the organic carbon pools only after several decades of cultivation, whereas the activity and structure of the microbial community changed gradually, seeming to be gradually selected over the time and showing the major differences between the less and the most recently anthropized soils.