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Abundance and activity of soil microorganisms in Cedrus atlantica forests are more related to land use than to altitude or latitude

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Several environmental traits might change the abundance and the function of soil microorganisms in forest soils by plant-mediated reactions. Few studies have related the landscape-scale forest structural diversity with the micro-scale distribution of microorganism and their activities. High mountain environments harbor ecosystems that are very sensitive to global change and hence highly vulnerable, as those of Atlantic cedar. Altitudinal gradients in mountains are orrelated with changes in vegetation. We propose that altitudinal gradients drive shifts in microbial communities and are correlated with land uses. Thus, the latitudinal and longitudinal pattern of abundance and activity of soil micro-organisms was studied in an intercontinental comparison. We investigate soil extractable organic carbon (EOC) and nitrogen and carbon, microbial biomass and microbial metabolic activities at eight different sites along the latitudinal range of Cedrus atlantica, covering different altitudes and soils characteristics both in Southern Spain and Northern Morocco. Analyses of the abundances of total bacteria, (16S rRNA gene), was conducted using the Ilumina metagenomics technique. Results show that the stands at the highest altitudes had distinct microbial and biochemical characteristics compared with other areas. Overall, microbial activity, as measured by soil respiration, is higher in forests subjected to lower human pressure than in stands highly degraded, probably reflecting the quality of litter input that results of the influence of local assemblage of different tree, shrub and annual species, though changes in the soil N and C contents. Indeed, total soil C and N contents explained the microbial properties at every scale. Our results suggest that in contrast to the observed pronounced altitudinal changes, the kind of human-mediate land management has a stronger role in defining changes in microbial composition and activities in the investigated forest systems.