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Impact of different land-uses on soil processes in Apennines environments

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In both Alpine and Apennines environments, the setting up of ski facilities has produced a considerable change in the soil use, with the transformation of former forested or cultivated (pastures) slopes into ski runs. The impact of these changes in land management, even if not subjected to mass movements and/or addition of allochtonous pedo-materials, can lead to soils degradation from the physical (disruption or deterioration of the soil structure and loss of slope stability) and chemical (pollution, alteration of the organic matter and nutrient cycles) points of view. For example, the artificial snow is heavier than the natural one and, consequently, induces a lower insulation of the soil and favours the freezing of the grasses and the upper soil horizons. In addition, artificial snow can also add pollutants and chemical additives into the soils. The modification of the ecological equilibria may affect the vegetation, with changes in the floristic composition, and may have negative effects on the biodiversity of these ecosystems.
Environmental damages became even worst during the last years following the global climate change, which brings to higher air temperatures and to a reduction of the snow cover duration. Because of this, the practice of artificial snow making is always more frequent to satisfy the need of protracting the skiing season.
The impact of the skiing facilities, with both natural and artificial snowing, is still rather unknown in the Apennines ecosystems, although their geographical position and the vicinity to the sea make these mountainous areas more susceptible to warming. For these reasons, we studied the skiing area of Sarnano-Sassotetto (Central Apennines, Italy), where the ski runs range from an altitude of 1260 to 1610 m. The effects of natural and artificial snow on the soil of the ski runs have been studied and the results have been contrasted with those of undisturbed areas. The effects of the different managements have been evaluated through the study of the soil C and N pools, soil basal respiration and soil temperatures recording. In particular, the organic C content was fractionated into WEOC (water extractable organic C), POC (particulate organic C), TEC (total extractable C), FA (fulvic acids) and HA (humic acids).
The results indicated that, during two winter seasons, the surface of the ski runs experienced a temperature < 0°C in January-February, while on the undisturbed areas the temperature was always around 0°C. Thus, the artificial snow and the snow grooming seemed to affect negatively the biomass production..
Total organic carbon content was higher in the undisturbed areas than in ski-runs, even though all the soils felt in the order of Mollisols. The organic carbon fractions of POC, TEC and HA showed the highest. values in the natural pastures.
The basal respiration experiments indicated that the soil microbial community was less active at 0.5°C than at 25°C, suggesting that the evolution to the atmosphere of the CO2 derived from the mineralization of the organic matter could increase considerably following the warming of these areas. Subnivean labile C and N pools in the surface horizons were comparable to those from snow-covered soils of the Alps, except for microbial C, which was higher in the Apennines soils than in the Alpine ones. This relatively large pool of biomass C may result in a potentially higher C mineralization in case of a warmer climate.
The achieved information will permit hypothesising guidelines for a correct and sustainable management of the ski resorts in the Apennines mountains and for the protection of the biodiversity of these ecosystems.

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