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## Health status Assessment of state-owned forest soils in the northern Apennines (Italy)

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Soil health is defined as the continued capacity of soil to function as a vital living system, sustaining biological productivity and maintaining or enhancing the quality of air and water, thus promoting the overall ecosystem health.

Erosion, incorrect forestry practices, excessive grazing and a changing climate are major threats to soil health in temperate forest ecosystems. Correct forest management is necessary to enhance the soil's capacity to provide essential ecosystem services such as water regulation, carbon storage and plant productivity.

Because of the growing interest on forest ecosystem services, the Rural Development 2014-2020 of Emilia Romagna Region Project "Technical innovation and carbon capture on management of state-owned forests of high Apennine (BOSCHIAMO)" addresses to strengthen the sustainable management and multi-functionality of some publicly owned forests in the high Apennine, mainly managed by park authorities, while monitoring carbon sequestration in the soil and plant biomass. Within this project, our specific aim was to assess the soil health of three forest sites located in state-owned forests in the Northern Apennines in Emilia-Romagna region (Italy), overlying sandstone formations at a height of approximately 1500 m. The land use was coppice or high forest beech (*Fagus sylvatica*), high forest spruce (*Picea abies*), high forest beech and silver fir (*Abies alba*) and included an area of moorland (*Vaccinium myrtillus*, *Vaccinium uliginosum*, *Juniperus nana*).

In each site, soil profiles, till BC horizon, were dug and each horizon was described, sampled, and analysed for physicochemical and biological parameters.

Soil health assessment was carried out via physicochemical and biological analyses and the calculation of two indexes: Dilly's index, which highlights the carbon use efficiency of soil microorganisms, and the index of biological fertility (IBF), which is obtained through the sum of scores assigned to significant parameters such as organic C, microbial biomass C content and its activity linked to basal respiration.

These ecosystems showed overall good health, scoring average, good or excellent IBF; Dilly's index was variable both in space and in depth but directed towards the efficiency of the use of C by microbial biomass. Significant differences in these indexes were found mainly in the subsoil,

where the site over the most alterable parent material performed better than sites with a higher coarse fragment content, and the coniferous or mixed forest performed better than the beech forest, while the moorland often showed the worst values. In these cases, the differences in IBF scores were linked to indicators of soil microbial activity. Carbon stock at 0-30 cm was very variable as it depends on many different processes and conditions and was heavily influenced by slope and the quantity of coarse fragments in the soil.

These results will serve as a baseline to quantify the impact on soil health of different logging techniques thus evaluating the best practices to preserve and enhance the ecosystem services provided by the soil.