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Organic and inorganic carbon in managed forest soils of the Emilia-Romagna Region (Northeastern Italy)

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Forest soils contain a large amount of carbon and play an important role in its global cycle. As forest soil organic carbon (SOC) mineralization is one of the major sources of atmospheric carbon, small changes of SOC can have effects on climate. Therefore, the Rural Development Programme (RDP) of Emilia-Romagna Region (Northeastern Italy) financed our *SuoBo* project, which aims to assess and preserve the quantity and quality of soil organic matter (SOM) in mountainous forest ecosystems located on the Apennine chain of the Emilia-Romagna Region. Our specific goal was to explore the response of SOC pools to forest thinning under two vegetation types. For this purpose, a chestnut forest of Beghelli farm (BEG), located at about 550 m a.s.l., and a mixed forest of Branchicciolo farm (BRA), located at about 225 m a.s.l, were selected. Soil samples were collected from each forest stand at 0-15 cm and 15-30 cm depths, in October 2020 in both farms and then in July 2021 in BRA farm and September 2021 in BEG farm. The soil samples were analyzed for the elemental contents and isotopic ratios ($\delta^{13}C$) of the soil total (TC), organic (SOC) and inorganic (SIC) carbon using an elemental analyzer coupled with an isotope ratio mass spectrometer. In October 2020, forest soil in BRA had higher TC, SOC, and SIC content in 0-30 cm (average: 7.1, 4.8 and 2.3 wt%, respectively) than in BEG (3.0, 2.8 and 0.1 wt%, respectively). The $\delta^{13}C_{TC}$ of the BRA soil is less negative than that of the BEG farm (–17.3‰ and –25.9‰, respectively) due to the higher SIC content, inherited by the parent rock mainly composed by limestones. In 2021, after one year since the thinning intervention, the TC and SOC contents in BEG soil were like those recorded in 2020, whereas those in BRA soils showed lower values. In particular in the superficial layer of BRA soils (0-15 cm), the SOC decreased from 6.9% to 4.1% in 2020 and 2021, respectively, while SIC content was unchanged (2.0 vs 2.1 wt%). Even in the deepest layer (15-30 cm) SIC remained the same over time (2.5 vs 2.4 wt%), while SOC decreased (2.5 vs 1.2 wt%). Also, the changes of $\delta^{13}C_{SOC}$ underlined a loss of organic matter from 2020 to 2021 (0-15 cm: –27.0 vs –26.2‰; 15-30 cm: –26.2 vs –25.9‰). Different concomitants may be contributing to this significant decrease in SOC: a) the different period of soil sampling (autumn vs summer), considering that the year 2021 is one of the seven warmest years on record globally and BRA has a lower altitude than BEG; b) the high slope (>45°) and the triggering of erosion process after the thinning intervention, which took away the surface soil, mainly characterized by organic hemitransformed horizons (*e.g.*, Oe horizons). The future planned analyses of the quality of the SOM through i) chemical extraction and separation of the different humic fractions and ii) stability of the C fractions at different temperatures with a

SoliTOC analyzer will shed a light on the prevailing phenomenon.