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Efficacy of pedogenetic horizons sampling for site-specific assessment of soil organic matter

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The role of soil organic carbon (SOC) in avoidance, mitigation and control land degradation in forest ecosystems is largely recognized. For these reasons, a satisfactory SOC monitoring aimed to drive sustainable SOC management is necessary to avoid soil forest degradation. In this work we thus aimed to a) compare the soil organic carbon stock (OC stock) obtained by pedogentic horizons (PED) and fixed depth layer (FIX) in different forest ecosystems; b) discuss the differences in SOC data provided by the two soil sampling approaches, clarifying their major advantages and drawbacks; and c) to assess the ability of PED and FIX sampling approaches to keep information about horizontal and vertical SOC distribution. On the Apennine chain (North Italy), uneven–aged sweet chestnut, European beech and Norway spruce forests were selected. In each site, a representative area (18 m × 18 m) has been selected and, in the centre of the area, a soil profile has been investigated. Further, within the representative areas 8 additional sampling points were identified. Both for soil profiles and the additional sampling points, soil collection was performed both by PED and FIX (0–15 and 15–30 cm). For each forest stand, no difference of OC stock in 0–30 cm soil depth was found between PED and FIX sampling approaches, however SOC distribution along 0-30 cm provided by PED sampling was more informative on SOC dynamics. The findings obtained through the sampling by FIX would indicate a positive effect of conifers on SOC storage, the PED sampling allowed to assess that SOC under spruce forest was greatly stored in the organic horizons (Oe and Oa) because of the recalcitrant nature of the spruce litter, that does not allow the organic carbon stabilization through the association with mineral particles. Therefore, the spruce forest soil would not lead structural stability and resilience to soil degradation. Sampling by PED also preserved the information about the spatial variability within each study site. In fact, we noted higher coefficient of variation when soil horizons were considered compared to FIX (from 19.2 to 72.8% and from 16.5 to 25.7%, respectively). Overall, in a view of SOC monitoring, our findings demonstrated that the sampling by PED draws a better picture of SOC distribution along depth and its potential susceptibility to external factors leading to degradation. Further, the loss of information about SOC stabilization process and spatial variability would indicate the inability of FIX sampling to support decision–making plans addressed for sustainable use of soil resource.