



Old growth mixed beech forest at the Hainich National Park still accumulates organic carbon in the subsoil

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Several studies have shown that the biomass in old growth forests still increases. The question remains if also soils under these forests continue to accumulate C and if so in which part of the soil? In March 2004 and 2009, 100 soil cores were taken along a grid (paired sampling) in the footprint of the eddy-covariance tower at an old growth mixed beech forest in the Hainich NP. The distance between sampling points was 30 m and the soil corer (8.7 cm Ø) was driven into the soil using a motor hammer to a soil depth of 60 cm where possible. Soil cores were cut into segments of 0-5, 5-10, 10-20, 20-30, 30-40, 40-50, 50-60 cm. Samples were air dried (40°C) after the removal of larger roots, sieved to < 2 mm and a subsample was ground using a ball mill prior to C and N analyses in an elemental analyzer. For the determination of carbonate contents, samples were combusted at 450°C for 16 h prior to C analyses.

In 2009, organic C (OC) concentrations were significantly higher in the upper 40 cm of the mineral soil than in 2004. At the same time, bulk densities were lower probably as a result of higher water and OC contents in 2009. Thus, changes in OC stocks were not significant when calculated per depth increment. When depth layers were translated into equivalent soil masses based on average soil masses per area and depth increment in 2004, soil OC stocks were significantly different between both sampling times in the uppermost and the third soil layer. In 2004, significantly more roots were sorted out from the uppermost layer than in 2009 indicating that some of the observed differences in C stocks could result from sample treatment. This cannot be responsible for the change observed in the deeper soil which corresponds to the 10-20 cm layer. Therefore we can conclude that the forest accumulated OC at a rate of 26 g m⁻²yr⁻¹ between 2004 and 2009 in the upper part of the B horizon (average depth of the A horizon was 9.7 cm). This result highlights the importance to include subsoil carbon in repeated soil inventories.