Vegetated subsoil exposed during geotechnical operations has massive carbon storage potential: a study of ^{13}C partitioning into soil respiration and different soil fractions

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Geotechnical operations such as embankments construction influence soil carbon (C) storage since massive amounts of C-poor subsoil are brought to the surface. We hypothesize that subsoil can sequester relatively more C than C-rich topsoil due to its lower C-saturation. We excavated topsoil (0.0 to 0.3 m) and subsoil (1.1 to 1.4 m) from the same profile. We sieved soil and sowed *Medicago sativa* and *Lolium perenne* (n=6 pots of each species x soil). Controls were soil with no vegetation (n=6 x soil). To trace the fate of C, pots were incubated for 6 months under a continuously 13C-enriched-CO2 (2%) in three growth chambers with controlled conditions. Soil respiration (CO_2 and ^{13}C) was quantified every 2 weeks and was higher in the topsoil, due to greater root and microbiological activity. The ^{13}C enrichment of the respired C was significantly higher in *M. sativa* regardless of soil type. After 6 months, soils were divided into four different fractions: particulate organic matter (POM), fine POM, silt, silt+clay, and total C and ^{13}C enrichment were analyzed. Results show that the total C (g new C/cm^3 soil) stored depended on root biomass. Topsoil had significantly more biomass, and stored more labeled plant derived-C, especially under *M. sativa*. However, when results were weighted as new C stored in cm^3 of soil per g of root biomass, subsoil stored relatively more C, especially in POM and silt+clay fractions (increase in new C stored in subsoil compared to topsoil for POM: *M. sativa* +135%, *L. perenne* +33% and for silt+clay: *M. sativa* +56%, *L. perenne* +16%). The higher relative increase of organo-mineral protected C in subsoil corroborates the hypothesis that C saturation influences C storage and protection. Vegetating subsoil with appropriate species could act as a major C sink, valorizing the geotechnical infrastructures as resources for carbon storage.