

Soil organic matter storage in beech forests: a quantitative and qualitative monitoring in central-southern Italy with forecasts under climate change

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Forests play an important role in the carbon cycle. For the ability to sequester CO₂ from the atmosphere and to accumulate the carbon for a long period in living biomass (aboveground and underground), in the dead biomass (litter, decaying wood, roots) and in the soil organic matter, they act as a C sink. Accordingly, nowadays it is estimated that they play an important role in climate change mitigation. The estimates of C bulks in different forest systems is uncertain and depending on several variables. Thus, it is essential to implement the information on carbon stocks, in particular at the level of the soil where, even today, the information is less abundant. One of the best studied forest tree species in Europe is the European Beech (*Fagus sylvatica* L.), which forms mostly monospecific stands in a wide range of site conditions and could be likely the most abundant plant in central Europe without human interference. Within the European context, the beech in peninsular Italy grows normally between altitudes of 800-1800 m along the Apennines, covering 9.4% of the country's total forest area (10.5 million ha) and accounting for up to 6.0 t C ha⁻¹ yr⁻¹ of carbon sequestration rate, similarly to tropical forests. In southern Italy, the Mediterranean climate is strongly affecting temperature and moisture regimes even at higher altitudes and, besides, the Mediterranean region is one of the most highly threatened by climate changes. The effect of these changes on decomposition rates and C dynamics in beech forests has not been investigated as much as in central Europe. The aim of this work was to monitor the quantity and quality of organic matter present between the organic and mineral soils down to 40 cm deep in 12 beech forests of southern-central Italy (from the Gran Sasso massif in Abruzzo to the Nebrodi mountains in Sicily), including 2 heterotopic stands (Monte Vulture in Basilicata and Foresta Umbra in Apulia). In this perspective, the estimate of the amount of the organic matter (OM) and organic C per square meter has been accompanied by measures of nitrogen, cellulose, lignin and lignin-like substances. The results highlight the great complexity in the patterns of distribution of OM in Apennines ecosystems and complex relationships with edaphic features, mostly depending on elevation of the stands. The stocks of C in beech forests in southern Italy is very high and this study presents basis and support to predictions of change in the C sink/source dynamics.