

Soil carbon accumulation after agricultural abandonment. A Mediterranean case study

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In the last decades, in Europe large agricultural areas have been abandoned. In absence of disturbance factors, renaturation of these areas is rapid due to secondary succession of vegetation communities. In the Mediterranean region, in the last years have been conducted studies on soil carbon accumulation after agricultural abandonment. Soil has to be regarded as the most considerable carbon (C) sink on a global level. CO₂ emission compensation is guaranteed also by C uptake by plants and by organic matter accumulation in soils. The present study analyzes organic carbon stock in some soils of Southern Italy, in the Madonie Mountains in Sicily, where large areas are subject to secondary successions because they have been abandoned by agriculture during the last 50 years. For the hilly and mountainous parts of the Madonie Mts., which are as a whole characterized by a Mediterranean climate, our aim was to: 1) quantify soil organic C accumulation after abandonment and 2) evaluate soil organic C variation as a function of bioclimate. The study areas selected ranged from 188 m to 1350 m a.s.l., and are representative of three distinct bioclimates (*sensu* Rivas-Martinez): thermomediterranean, mesomediterranean and supramediterranean. For each bioclimate several study plots representing three successional stages were chosen: pasture, mantle and forest. In the thermomediterranean belt we studied only pastures and mantles, due to forest absence. In each plot two soil samples were collected at 0-10 cm and 10-30 cm depth. Results of the soil sample analysis showed an increase of soil organic C stock from thermomediterranean to supramediterranean soils, for both soil depths. In the thermomediterranean belt, no significant difference was found between the succession stages pasture and mantle. Also in the mesomediterranean belt, where total organic C stocks were higher than in the thermomediterranean belt, there were no significant differences between pasture and mantle plots, but forests showed significantly higher stocks than the younger succession stages. In the even cooler bioclimate, i.e. the supramediterranean one, we found the highest organic C stocks, but also here we found no significant differences between the succession stages. This study confirms one of the general principles of soil organic C accumulation for our study area: soils in cooler and more humid conditions represent higher potentials as carbon sinks compared to soils in warmer and drier conditions. Moreover, we can conclude that bioclimate is a more important factor for C accumulation than abandonment age or succession stage. With decreasing altitude, the differences between forests over mantle and pasture communities increase. Bioclimate plays a major role for the differences between succession stages above all at 0-10 cm soil depth. These kind of evaluation studies on soil C dynamics after agricultural abandonment assume an increasing importance, also after the Accords of Marrakech. In fact, according to FAO data, Italy is one of the countries where land cover change is mainly characterized by the increase of wooded lands.