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How do soil properties and soil carbon stocks change after land abandonment in Mediterranean mountain areas?

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Land abandonment and subsequent revegetation processes (due to secondary succession and afforestation practices) are global issues with important implications in Mediterranean mountain areas. Moreover, the effects of land use changes on soil carbon stocks are a matter of concern stated in international policy agendas on the mitigation of greenhouse emissions, and afforestation practices are increasingly viewed as an environmental restorative land use change prescription and are considered one of the most efficient carbon sequestration strategies currently available. The MED-AFFOREST project aims to gain more insight into the discussion by exploring the following central research questions: (i) what is the impact of land abandonment on soil properties? and (ii) how do soil organic carbon change after land abandonment? The main objective of this study is to assess the effects of land abandonment, land use change and afforestation practices on soil properties and soil organic carbon (SOC) dynamics. For this aim, five different land covers (bare soil, meadows, secondary succession, Pinus sylvestris (PS) and Pinus nigra (PN) afforestation), in the Central Spanish Pyrenees were analysed.
Results showed that changes in soil properties after land abandonment were limited, even if afforestation practices were carried out and no differences were observed between natural succession and afforestation. The results on SOC dynamics showed that: (i) SOC contents were higher in the PN sites in the topsoil (10 cm), (ii) when all the profile was considered no significant differences were observed between meadows and PN, (iii) SOC accumulation under secondary succession is a slow process, and (iv) meadows should also be considered due to the relative importance in SOC stocks. The first step of SOC stabilization after afforestation is the formation of macro-aggregates promoted by large inputs of SOC, with a high contribution of labile organic matter. However, our respiration experiments did not show evidence of SOC stabilization. SOC mineralization was higher in the top layers and values decreased with depth.
These results put the question forward which type of forest and landscape management is most appropriate to decide for the best practices after land abandonment for soil recovery and soil organic carbon dynamics.

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