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The effects of land abandonment and long-term afforestation practices on the organic carbon and lignin content of a Mediteranean soil

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THE EFFECTS OF LAND ABANDONMENT AND LONG-TERM AFFORESTATION PRACTICES ON THE ORGANIC CARBON AND LIGNIN CONTENT OF A MEDITERANEAN SOIL

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Abstract
Afforestation is an important strategy that can decrease atmospheric carbon in sequestering it in biomass and soils (Pérez-Crusado et al., 2014). In Spain an active afforestation program was adopted in the 1950s, when after wide spread land abandonment the soils were severely eroded (FAO, 2015). In this research the organic carbon and lignin content of the soils in the Araguás catchment area in the Spanish Pyrenees were examined. This research is part of a larger research examining the effect of afforestation over time (Med Afforest Project, PIEF-GA-2013-624974). The research area was afforested with both the P. sylvestris (Scotts Pine) and the P.nigra (Black Pine). Both sites were compared to bare soil (representing severely eroded soil), natural secondary succession (re-vegetation) and meadows. The method used to assess the lignin content is Curie-point pyrolysis with tetramethylammonium hydroxide (TMAH). The results showed a reducing trend for the soil organic carbon (SOC) content with depth. The highest SOC and lignin contents in the topsoil were found under P.nigra and secondary succession. This decline in lignin content corresponds with a high degradation rate (Ad/Al) in the top soil and lower degradation rates in depths of >20 cm. Meadows showed an increased SOC content in deeper horizons, which corresponds to high lignin content as well. In which the meadows showed an increase in lignin content for the soil depths of >20 cm that was unusual and could not be explained by the S/G and P/G ratios and the degradation ratio (Ad/Al). According to the results, P. nigra was the best afforestation practice for increasing the SOC and lignin contents in the soil. The P. sylvestris was considered but proved to be less successful than natural secondary succession.

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