

Long-term effect of land use change on soil quality: Afforestation and land abandonment in semi-arid Spain

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Soils under the Mediterranean climate are vulnerable for degradation, especially after land abandonment. Abandonment is an important factor in the Mediterranean landscape as vegetation regeneration is hampered due to the characteristic semi-arid and sub-humid Mediterranean climate regime. During the past 70 year extensive afforestation projects have been conducted with the aim to protect landscapes and soils against degradation. While large investments are still being made, little is known about the impact of afforestation on soil quality on a longer time scale.

During the past decade, there is a growing interest in qualifying and quantifying the carbon storage in soils by such afforestation projects, to get a better understanding of the carbon cycle and look for possibilities to fixate atmospheric CO₂ in the soil. It is generally accepted that afforestation projects will increase the soil carbon pool, but data on this process is scarce.

Therefore an intensive fieldwork has been carried out in Murcia, southeastern Spain to study the effects of land abandonment and afforestation on soil quality along a chronosequence and included two afforested areas (from the early '70s and 1993). The *Pinus halepensis* trees were planted in rows, for which the underlying calcrete was broken. Samples were taken to study changes in soil quality (Aggregate stability, Corg, N, P, K, Na), Soil Organic Carbon (SOC) stocks and soil hydraulic properties, such as infiltration and water retention, between the afforestation projects, abandoned agricultural plots of similar age, semi-natural vegetation, cereal crop fields and almond orchards. As the natural vegetation is characterized by a spotted pattern of bare areas and trees, forming so-called "islands of fertility", both bare and vegetation covered sub-sites were sampled.

First results showed a positive effect of both land abandonment and afforestation on the soil aggregation. Especially the 40-year-old plots showed underneath trees similar values as the semi-natural sites, while the open areas in the afforested sites lag behind. Especially the soil at a depth of 10-20 cm showed a clear decrease in aggregate stability, while the surface layer showed a clear increase in aggregate stability. Abandonment sites showed a non-linear increase in soil quality, which means that aggregate stability slightly declines after 20 year of abandonment, but the positive change was less than on the afforested sites.

Changes in vegetation along the chronosequence studied, could be expected to have an impact on organic matter input quality and quantity. Such changes in vegetation cover, structure and composition were not observed for the afforested sites in the field, but preliminary results suggest that the 40-year-old afforested sites could have a higher soil quality than the semi-natural sites.