

## Effect of Land Use and Abandonment on Soil Carbon and Nitrogen Depletion by Runoff in Shallow Soils under Semi-Arid Mediterranean Climate

**Authors :** Mohamed Emran, Giovanni Pardini, Maria Gispert, Mohamed Rashad

**Abstract :** Land use and abandonment in semi-arid degraded ecosystems may cause regressive dynamics in vegetation cover affecting organic matter contents, soil nutrients and structural stability, thus reducing soil resistance to erosion. Mediterranean areas are generally subjected to climatic fluctuations, which modify soil conditions and hydrological processes, such as runoff and water infiltration within the upper soil horizons. Low erosion rates occur in very fragile and shallow soils with minor clay content progressively decrease organic carbon C and nitrogen N pools in the upper soil horizons. Seven soils were selected representing variant context of land use and abandonment at the Cap de Creus Peninsula, Catalonia, NE Spain, from recent cultivated vines and olive groves, mid abandoned forests standing under cork and pine trees, pasture to late abandoned Cistus and Erica scrubs. The aim of this work was to study the effect of changes in land use and abandonment on the depletion of soil organic carbon and nitrogen transported by runoff water in shallow soils after natural rainfall events during two years with different rainfall patterns (1st year with low rainfall and 2nd year with high rainfall) by i) monitoring the most significant soil erosion parameters at recorded rainfall events, ii) studying the most relevant soil physical and chemical characteristics on seasonal basis and iii) analysing the seasonal trends of depleted carbon and nitrogen and their interaction with soil surface compaction parameters. Significant seasonal variability was observed in the relevant soil physical and chemical parameters and soil erosion parameters in all soils to establish their evolution under land use and abandonment during two years of different rainfall patterns (214 and 487 mm per year), giving important indications on soil response to rainfall impacts. Erosion rates decreased significantly with the increasing of soil C and N under low and high rainfall. In cultivated soils, C and N depletion increased by 144% and 115%, respectively by 13% increase in erosion rates during the 1st year with respect to the 2nd year. Depleted C and N were proportionally higher in soils under vines and olive with vulnerable soil structure and low soil resilience leading to degradation, altering nutrients cycles and causing adverse impact on environmental quality. Statistical analysis underlined that, during the 1st year, soil surface was less effective in preserving stocks of organic resources leading to higher susceptibility to erosion with consequent C and N depletion. During the 2nd year, higher organic reserve and water storage occurred despite the increasing of C and N loss with an effective contribution from soil surface compaction parameters. The overall estimation during the two years indicated clear differences among soils under vines, olive, cork and pines, suggesting on the one hand, that current cultivation practices are inappropriate and that reforestation with pines may delay the achievement of better soil conditions. On the other hand, the natural succession of vegetation under Cistus, pasture and Erica suggests the recovery of good soil conditions.

**Keywords :** land abandonment, land use, nutrient's depletion, soil erosion

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