

Effects of land use management, landscape forms and soil types on soil organic carbon in the watershed of Wadi Beja in Northwest of Tunisia.

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Abstract:

Understanding changes in soil quality resulting from land management changes, landscape forms and soil types is crucial to design sustainable land management plans and interventions. This study evaluated the influence of land use/management, landscape forms (slope/aspect) and soil types on soil organic carbon (SOC) which is a key soil quality indicator within a watershed of Wadi Beja in the northwest of Tunisia. Factor analysis based on Multiple Correspondence analysis (MCA) was used to visualize relationships between the selected factors. Surface (0–20 cm) soil samples were collected from four main LU/management types in the watershed (i.e., field crops, Permanent crops, plantation forest, grazing land) and at two aspects classes (north and south), 3 slope classes (flat, moderate and steep) and 7 different type of soils (Vertisols, Pedosols, brown calcareous, Isohumic, regosols and rendzinas). A soil spectral library was developed and used to assess the variation of the SOC across all the selected variables. A factorial analysis of variance ANOVA showed that all the variables significantly affected the soil organic carbon (SOC) levels. Under the grazing land use, the aspect, slope and soil types together affected significantly the SOC levels. Under the permanent crops land use, only the slope and the soil type affected significantly the SOC levels. Under the field crops, only the slope has a significant effect as well. However, in the forest, there is no significant effects of any of the selected variables on the SOC. The afforestation of the field crops with olive trees can significantly increase the SOC at different levels of slopes especially in vertisols and brown calcareous soils. Since 71 % of the area is field crops land use system includes 64 % of steep terrain under intensive monoculture, SOC level appear better in flat area compared to others. Regarding grazing lands, level of SOC was increased significantly in the flat and north facing areas particularly in brown calcareous soils.

Soil fertility decline on sloping agricultural land poses a serious problem for the environment as well as for soil quality and productivity. In areas with highly erodible soils, such as those in steep slopes and south facing zones, application of soil and water conservation measures is crucial to sustain agricultural fields and to prevent or reduce soil degradation. There is strong indications that agroforestry have been successful in retaining soil fertility.

Keywords: SOC, landscape, land use management, ANOVA, MCA