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Vertical distribution of soil organic carbon originated from a prior peatland in Greece and impacts on the landscape, after conversion to arable land

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The vertical distribution and the status of soil organic carbon (Corg.) in 66 surface and subsurface soil samples were investigated. These soils originated mainly from organic deposits of Philippoi (northern Greece) have been classified as Histosols and belong to the suborder of Saprists. The present study consisted of an area of 10,371 ha where about 90% of the soils are organic. The main crops are maize (Zea mays L.), sugar beets (Beta vulgaris L.), tobacco (Nicotiana tabacum L.), cotton (Gossypium hirsutum L.), tomatoes (Lycopersicon esculentum Mill.), and wheat (Triticum aestivum L.).The surface horizons consist mainly of well-humified organic materials mixed with mineral soil particles. Usually, they have moderate or insufficient drainage regime and conditions become favorable for microbial growth. Microbes decompose and transform the soil organic compounds into mineral forms, which are then available as nutrients for the crop. The organic matter was derived primarily from Cyperaceae (Cladium mariscus, various Carex species, etc.) and from decomposed residues of arable crops. The dominant features of these soils are the high content of organic matter and the obvious stratification of soil horizons. In contrast, most arable soils in Greece are characterized by low organic matter content. The stratification differentiates the physical and chemical properties and the groundwater table even during dry summers lies at depths,150 cm beneath surface. The Corg. content was high and varied greatly among the examined samples. In the surface layers ranged between 3.57 and 336.50 g kg2 (mean 199.26 g kg2) and between 22.10 and 401.10 g kg2 in the subsurface horizons (mean 258.89 g kg2). It can be argued that surface layers are drier and part of soil organic matter was seriously affected by the process of oxidation. At drier sites, soil subsidence was appeared as a consequence of soil organic matter oxidation. Increased contents were found in the northern part of the studied area, where soil moisture is usually higher. Similarly, higher contents were found at low-lying places or in hollows, due to drainage and consequent cultivation in the plowing horizons. The Corg. was highly correlated with total soil nitrogen, which is mainly bound into the soil organic matter. The studied soils are vulnerable to management, which strongly affects their properties. Under thermic temperature conditions, soils located in the slopping margin, where moisture regime is drier, can be decomposed relatively easier and faster. Rational water management, tillage practices, avoidance of heavy machinery, and proper fertilization could contribute to the soil and water quality, without significant yield reduction. Furthermore, a set of additional measures in the examined organic soils can be applied, such as: banning of plant residues burning, avoidance of deep ploughing, maintenance of a shallow water table and the partial conversion of arable soils into pasture land. Potential alternative uses and a number of practices can be suggested for proper soil management, such as: incorporation of crop residues after harvesting into subsoil, implementation of proper rotation schemes, and in some cases rational fertilsation and irrigation management to increase productivity. This investigation also provides a quantitative estimation of the soil carbon status per hectare, and an attempt was made for the interpretation of factors which affect the distribution of Corg. within the examined surface and subsurface soil layers.