

ASSESSING AND MAPPING TOPSOIL ORGANIC CARBON STOCK AT REGIONAL SCALE: A SCORPAN KRIGING APPROACH CONDITIONAL ON SOIL MAP DELINEATIONS AND LAND USE

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ABSTRACT

In order to assess the potential of soils as C reservoir at regional scale, accurate estimates of soil organic carbon (SOC) are required, and different approaches can be used. This study presents a method to assess and map topsoil organic carbon stock (Mg ha^{-1}) at regional scale for the whole Emilia Romagna plain in Northern Italy (about $12\,000\text{ km}^2$). A Scorpan Kriging approach is proposed, which combines the trend component of soil properties as derived from the 1:50 000 soil map with geostatistical modeling of the stochastic, locally varying but spatially correlated component. The trend component is described in terms of varying local means, calculated taking into account soil type and dominant land use. The resulting values of SOC, sand, silt, and clay contents are retained for calculating topsoil SOC stocks, using a set of locally calibrated pedotransfer functions (PTFs) to estimate bulk density. The maps of each soil attribute are validated over a subset of 2000 independent and randomly selected observations. As compared to the standard approach based on the mean values for delineation, results show lower standard errors for all the variables used for SOC stock assessment, with a relative improvement (RI) ranging from 4 per cent for SOC per cent to 24 per cent for silt. The total C stock (0–30 cm) in the study area is assessed as $73.24 \pm 6.67\text{ Mt}$, with an average stock of $62.30 \pm 5.55\text{ Mg ha}^{-1}$. The SOC stock estimates are used to infer possible SOC stock changes in terms of carbon sequestration potential and potential carbon loss (PCL). Copyright © 2010 John Wiley & Sons, Ltd.

KEY WORDS: carbon stocks; soil type; scorpan; geostatistics; pedotransfer functions; bulk density; kriging; soil organic carbon; Italy