Geophysical Research Abstracts,
Vol. 11, EGU2009-2204-1, 2009
EGU General Assembly 2009

Integrating soil map delineations properties and land use into soil carbon density assessment at regional scale (Emilia Romagna, Italy)

F. Ungaro and C. Calzolari

CNR IRPI, Applied Pedology, Sest Fiorentino (FI), Italy (fabrizio.ungaro@irpi.cnr.it, 0039 055 5226550)

Accurate estimates of soil organic carbon (SOC) at regional scale are important to estimate the potential of soils as C reservoir. Different approaches can be used resulting in different degree of uncertainty associated to the estimates (Ungaro et al, 2005). Among the major source of uncertainty, land use, soil variability and bulk density for the reference depth are those with the greater influence on the final SOC stock estimation (Meersman, 2007). In order to reconstruct the spatial patterns of SOC at the landscape scale and to reduce the uncertainty associated to SOC stock estimates, an hybrid approach has been developed, combining the properties of the delineations of the regional 1:50.000 soil map with a geostatistical procedure (sequential Gaussian simulation). In the alluvial plain area of Emilia Romagna (10,734 km^2) in Northern Italy, the available spatially explicit soil data (17,652 horizons from 3,302 profiles,), from 237 soil typological units, have been referred to 13 soil functional groups, divided in 42 subgroups. Based on the main geomorphic and pedogenetic processes, the soil functional groups and subgroups are defined in terms of top-soil textural classes (texture family), drainage class, slope, presence of organic materials (O horizons), flooding occurrence, origin of the parent material and presence of limestone. In order to take into account the influence of land use, the observations within each functional group have been further divided according to the different agricultural districts of the plain, characterized by different dominant land uses. The SOC density (Mg ha^{-1}) of the 100 cm reference depth has been calculated as a weighed sum of the values calculated for each horizon., using a set of locally calibrated pedotransfer functions (Ungaro, 2007) whose inputs beside organic C are the sand, silt, and clay textural fractions The average values of each soil functional (sub)group of each district were used to assign a SOC density (Mg ha^{-1}) value to each delineation of the 1:50.000 map. These values were then used to condition the outcomes of geostatistical parametric simulations. The resulting map shows, quantitatively and explicitly accounting for spatial uncertainty, the strong dependence of SOC stock on the main agricultural and pedological landscapes. The results show that the pattern of local land use in combination with soil type has a relevant impact on the SOC stored in cropland. The overall pattern is clearly affected by dominant land use at district level, with the areas characterized by a dominance of permanent grassland storing nearly twice as much the areas dominated by orchards, and by local soil conditions, in particular along the Apennines' foothills, in the lowlands of the plain and in the reclaimed areas of the ancient Po river delta. The average SOC density is 153.27 ± 6.27 Mg ha^{-1} for the whole plain, with a total C stock of 159.01 ± 6.71 M t. However, the figures range from the 258.89 Mg ha^{-1} for the recently reclaimed area near the Po delta, characterized by organic soils, to the 147.74 Mg ha^{-1} of the districts characterized by a strong dominance of fodder crops, and to the 91.71 Mg ha^{-1} for the more intensively cropped districts dominated by orchards. This may have a direct consequence on the regional policies for implementing measures for soil C sequestration.