THEME 1

A Bottom-up approach to estimate SOC in Italy

Ialina Vinci Charlotte, F. Fumanti, P. Giandon, S. Obber, M. Di Leginio
ARPAV - Veneto Region Environmental Protection Agency; ISPRA

INTRODUCTION

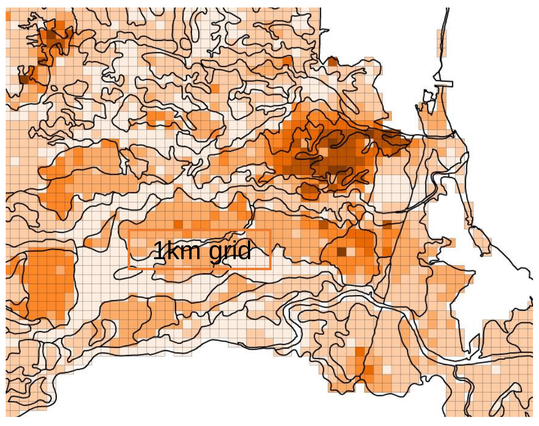
A bottom-up approach to develop soil indicators

Soil is a non-renewable resource increasingly under pressure, therefore there is an urgent need for consistent and reliable information on soil. Comparability of information on soils is limited, often based on few data, collected using different methodologies. The Italian Institute for Environmental Protection and Research (ISPRA) has financed and started the SIAS project to develop a new approach that exploits the more updated and detailed information on soil and the expertise available at local level to build reliable indicators on some soil threats at national level. Focused on loss of organic matter and soil erosion (two of the main threats identified by the European Commission) the pilot project involved 16 Regional Soil Survey Services out of 20 regions and CREA (National Council for Research in Agriculture). Special emphasis of the project lays on exploitation of local expert judgement ("bottom-up" approach): local experts can follow the most adequate assessment procedures up to their judgement, as long as procedure paths are recorded into metadata.

OBJECTIVES

Exploiting detailed and up-to-date regional soil data

To reduce harmonization problems, regional soil services filled a 1 km grid with data and metadata.



Map 2: 1 km grid

To collect pixel data and meta-information, an exchange format was set up. It stores together with soil organic carbon stocks, also data quality indicators and confidence levels. Organic carbon stock (t ha^{-1}) has been calculated for 0-30 cm and 0-100 cm.

In order to have a comparable assessment, organic carbon data obtained by means of local analytical methods have been converted into ISO method results, thanks to a ring test worked out among several Italian laboratories.

METHODOLOGY

Different methods for different situations

Approaches used for organic carbon stock evaluation were different, suited to data availability and expertise. In areas where soil maps were available, carbon stock was estimated as weighted average derived from Soil Typological Units in the Soil Mapping Unit (SMU) or as average value of point observations within the SMU. Geostatistical analysis could be applied, where the observation density was higher and local expertise adequate. Concerning bulk density, both measured data and pedotransfer function (PTF) data were used; in some cases original PTFs, calibrated on own measured datasets, were used, in other, literature PTFs.

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

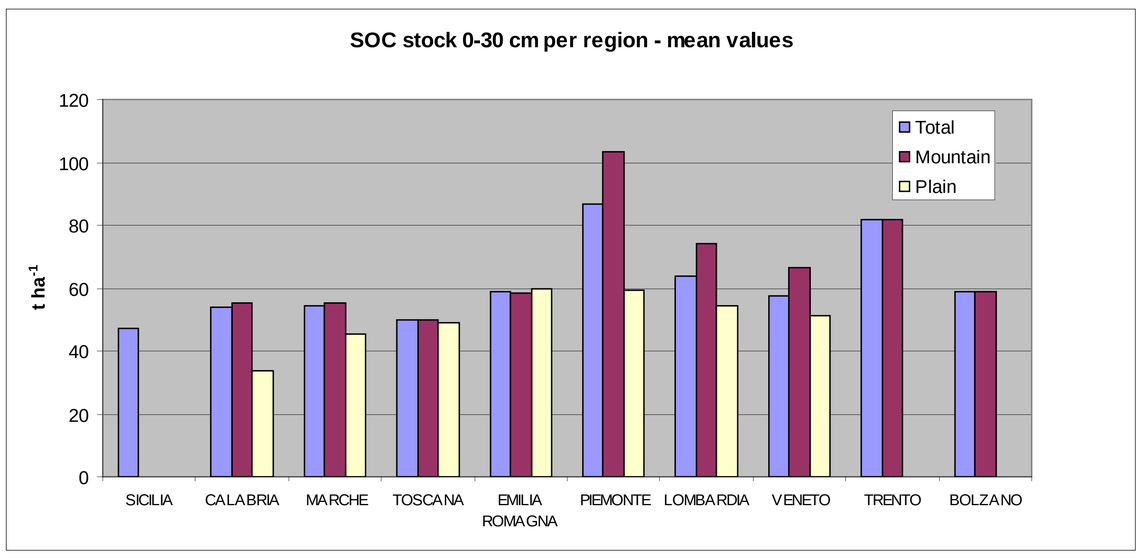
arpav

MAIN RESULTS

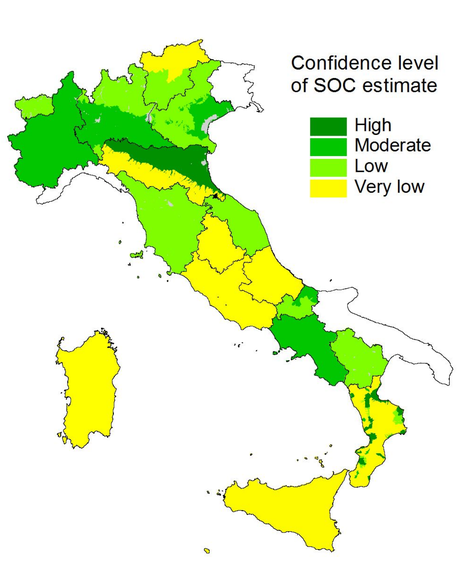
Soil Organic Carbon stock

Average SOC in plain areas goes from 34 to 60 t ha^{-1} in the 0-30 cm section, with the lowest values in southern Italy (34 t ha^{-1}) and the highest (51-60 t ha^{-1}) in the north (Po plain). Average SOC in the 0-100 cm section ranges from 78 to 154 t ha^{-1} in the plain, with the same geographical trend.

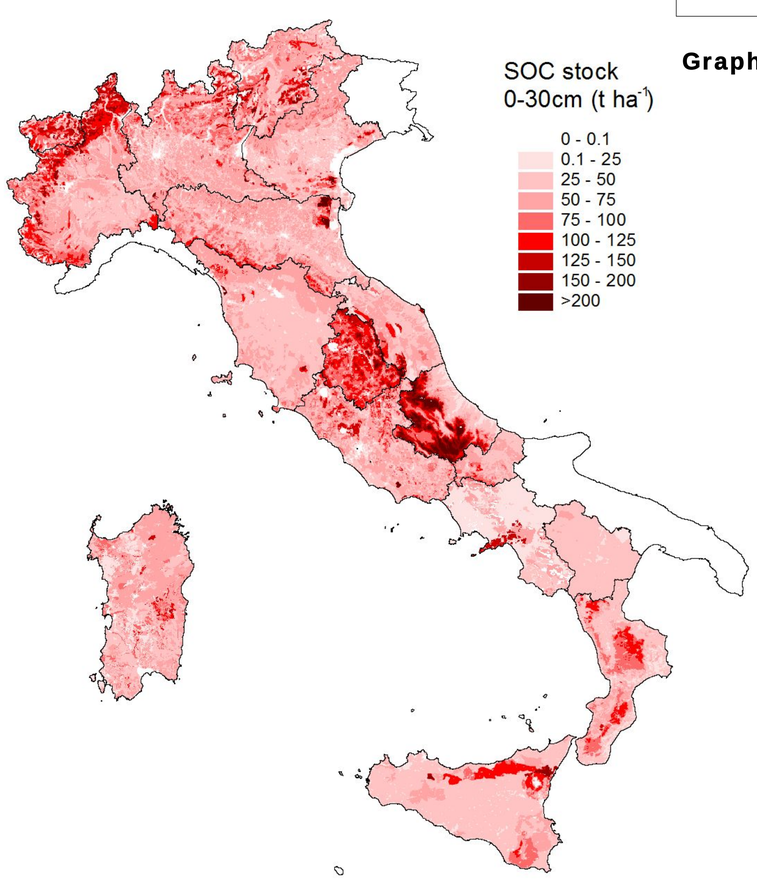
In the Alps SOC is quite variable, going from 59 to 103 t ha^{-1}, on average, for the 0-30cm section, and from 87 to 160 t ha^{-1}, for the 0-100cm. Central and southern mountain areas (Appennini) have average contents of 50-58 t ha^{-1} within 30 cm and 95-114 t ha^{-1} within 100 cm.



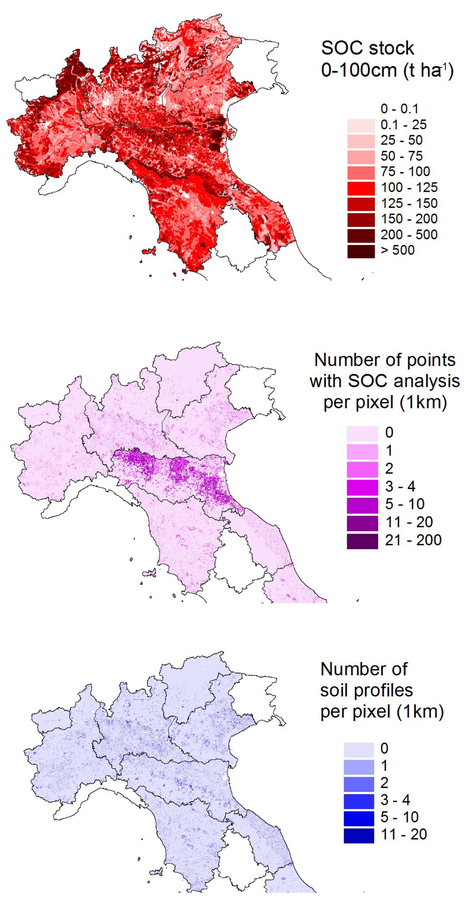
Graph 1: SOC stock 0-30 cm per region



Map 1: Confidence level of SOC estimate in Italy



Map 3: SOC stock 0-30 cm t ha^{-1}



Map 4: SOC analysis

CONCLUSION

Strength and weaknesses

Main problems were different know-how and data availability in different regions, but a group of more expert regions acted as technical guide for other, less experienced, regions. Bulk density assessment turned out to be a weakness point, since different PTFs often give very different results. Several regions had large datasets of measured bulk densities, that were used to develop local PTFs; these turned out to be very useful also to other regions with similar environments. SIAS project was the first attempt to provide consistent information about soil organic carbon stock in Italy, coherent with European and international standards.