Soil Organic Carbon modeling in the Mediterranean Basin: an assessment of the existing international scientific research through a Systematic map

Calogero Schillaci (1), Sergio Saia (2), Alessia Perego (1), and Marco Acutis (1)

(1) Department of Agricultural and Environmental Science, University of Milan, Italy, (2) Council for Agricultural Research and Economics (CREA-CI), Vercelli, Italy

Soil organic carbon (SOC) is a pivotal trait of soil health and its stock has direct implication for climate change. Thus, SOC assessment is a prerequisite to sustain crop and ecosystem productivity, resilience and ecosystem service. Digital soil mapping (DSM) has allowed for various spatial and time scales soil analysis. This permitted the spatial and temporal interpretation of SOC variation from the plot to the regional scale. This also offered many interpretations of the SOC distribution and dynamics and the effect of its predictors. However, the most studies were made in temperate or cold environments from central and northern Europe or United States or in stably arid ecosystems of Australia.

Spatial information on SOC regional variability are often disjointed each other, especially in the Mediterranean areas. This impairs the comparison of SOC dynamics and policy decisions to preserve SOC.

Thus, we carried out a systematic map of peer-reviewed papers in the Web of science (WoS) and Scopus databases to highlight knowledge gaps in SOC studies in the Mediterranean Basin. We retrieved 500 articles in WoS and 750 in Scopus, but only part of them were eligible as ad hoc studies. In total, only 213 studies (of which 128 from WoS and 104 from Scopus and only 19 in common) were eligible for inclusion in the final map (1995- 2018). Among all the countries around the Mediterranean Basin reports on SOC modelling and mapping have been carried out in 13 countries. However, the very most of them were performed in Spain, France, and Italy. Notably, our analysis (Schillaci et al. 2018. Rend. Online Soc. Geol. Ital. 4, 161–166) does not present reports from the grey literature and thus additional research in other databases must be carried out. Also, screening for unconventional terms should also be performed to scavenge studies not citing SOC in the title, abstract and keywords but still reporting it.

Main data gaps were identified as (1) absence of long-term monitoring networks in the south of Europe (with datasets spanning less than 20 years), (2) scarcity of information from countries on the eastern coast of the Adriatic and Mediterranean Sea, and (3) lack of detailed information on SOC models and maps from the Near East and North Africa region. Model exportation built in neighbourhood countries (e.g. from Sicily, Italy, to northern Tunisia, or Andalusia, Spain, to northern Morocco) could partly overcome such a lack of knowledge.

After this preliminary study, a broader meta-analysis is planned for studies on large dataset of SOC in many areas with Mediterranean climate, either into the Mediterranean basin or not. The results can be used to improve communication between policy makers and farmers and to allow for a better regional agro-environmental modelling.