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EDITORIAL

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Editorial for soil organic matter 2019 special issue

Soil organic matter (SOM) is a unique component of the soil that, because of its heterogeneity, directly or indirectly affects its physical, chemical and biological properties, and the functions that depend on the interaction of those properties. Forms of SOM have an aggregating and stabilizing effect on soil particles, creating the system of aggregates and pore networks that control soil hydraulic functions and root penetration. In part, SOM affects soil biochemical reactions, such as controlling the availability and immobilization of nutrients through its impact on soil pH, and its ability to buffer the effects of contaminants. As the driver of soil biology, and particularly microbiology, SOM controls nutrient turnover and stabilization of soil carbon (C).

The *European Journal of Soil Science* (*EJSS*) and its predecessor have always reflected the growing research interest in the interactions between SOM and soil properties and functions and has showcased a significant body of work that has improved our understanding. It was perhaps no surprise that the first in the "*Landmark*" series of papers republished by *EJSS* with present-day reflective commentaries was the pioneering thesis by Tisdall and Oades (1982) on the close relationship between SOM and a soil property (soil aggregate stability), which remains the most-cited publication in *EJSS*.

The biennial *International Symposium on SOM* is now firmly embedded in the soil science conference calendar, beginning with its inception at Poitiers in 2007. In September 2017, the 6th Symposium met at Rothamsted Research in the UK, with the current Editor-in-Chief (EiC) of *EJSS*, Professor Jennifer Dungait, as Chair, and with considerable support from the British Society of Soil Science. The choice of location was an easy one: Rothamsted has a rich history of research into the effect of agricultural management on SOM dynamics, in particular because of the career and legacy of Professor David Jenkinson (Powlson & Brookes, 2017), to whom the symposium was dedicated. The symposium attracted 400 attendees from around the world. This special issue shares a selection of 12 papers that were presented at the symposium as a testament to our contemporary understanding of SOM.

The first four papers focus on fundamental and methodological aspects of SOM. Guber, Kravchenko, Razavi, Blagodatskaya, and Kuzyakov (2019) present a methodological paper on the new technique of soil zymography, developed to visualize two-dimensional distributions of enzyme activities using fluorescence. This novel technique requires significant decision making by the user, and the authors discuss various options to exploit the exciting potential for capturing the spatial and temporal dynamics of enzymes in soil. Moragues-Saitua, Merino-Martín, Stokes, and Staunton (2019) propose methodological improvements to the quantification of the operationally-defined glomalin-related soil protein fraction of SOM in a range of soils under varying land uses and discuss its potential as a key indicator of stabilized SOM and its dynamics. Zavarzina et al. (2019) consider the origins of SOM formation in a study of water-soluble phenolic compounds in lichen that are often pioneer organisms in extreme environments. Fungal communities and soil respiration responses to above- and belowground C inputs were explored by Shi et al. (2019) using litter or root exclusion to demonstrate the importance of aboveground C inputs to soil.

Five papers investigate the effects of management on SOM. You et al. (2019) report greater initial SOM, greater SOM mineralization when aggregates were disturbed, and a greater priming effect of native SOM after the addition of substrates to soil under grassland management, compared to arable or fallow management, confirming how management affects soil physical properties, and the nature and vulnerability to loss of the SOM that is protected within structures. Paddy rice systems are examined in two papers. Wu et al. (2019) report how long-term fertilization of paddy rice can decrease the ability of humic SOM compounds to inhibit phytopathogenic fungi, emphasizing the effect of management on the nature and quality of SOM. Xiao et al. (2019) used a pulse-labelling approach to reveal that N fertilization increased belowground C in paddy rice systems that was confined to the root biomass and rhizosphere, particularly in the early growth stages. The paper by Celestina, Sale, Tang, and Franks (2019) reports how organic and inorganic amendments, applied principally to ameliorate sodic soils, can affect the microbial community in the surrounding bulk soil, suggesting the migration of nutrients away from their source. Lee, Hwang, Park, Kim, and Lee (2019) report that the use of film mulching, used to increase crop yields by improving soil moisture and temperature condition, increased the respiration of C and hence potential loss of SOM.

The final three papers focus on important aspects of SOM models and their development. Cagnarini et al. (2019)

used data from a long-term experiment to test a multi-objective parameter approach for the RothC model, based on microbial biomass, respiration and SOM fractionation data. Estimation of belowground inputs of C was recognized as a major challenge to SOM models. Cavalli, Bellocchi, Corti, Marino Gallina, and Bechini (2019) provide an assessment of individual process-based modules of SOM models using a sensitivity analysis. This work suggested that a parameter describing substrate use efficiency was the best predictor of net C respiration and N mineralization. Ťupek et al. (2019) used a Bayesian approach to assess the ability of two other process-based models to estimate soil C stocks and respiration losses in forest soils. They emphasize the importance of climate modifiers in such process-based models to improve prediction.

The 7th Symposium in the series is to be held in October 2019 in Adelaide (see http://www.som2019.org/), with the theme of *"SOM in a stressed world"*. It will have a particular focus on understanding the stressors that impact on the ability of soil to continue to deliver key functions in the face of a number of critical global challenges, including food and water security, population growth and sustainable development, all to be achieved under a changing climate. We are pleased that *EJSS* will run a special issue associated with the 7th Symposium, ensuring that SOM remains a keystone theme of *EJSS*, sure to build on the diverse range of research presented in this special issue.

We would like to acknowledge the great help and support of Professor Margaret Oliver, who oversaw much of the compilation of this special issue as the former EiC, Professor Dungait as current EiC, who saw it across the line, and the *EJSS* publication team. Finally, we wish to thank the contributing authors and offer our sincere gratitude to all the reviewers, without whom this special issue could not have been completed.

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