

## Editorial for Anniversary Special Section

### A profile of seventy years of soil research

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As current and recent presidents it has been a privilege and a pleasure on behalf of the British Society of Soil Science to assemble articles for the special anniversary issue of the *European Journal of Soil Science* (EJSS) and *Soil Use and Management* (SUM). The papers assembled reflect the spectrum of contemporary issues in soil science, which also serve as a reminder of how our soil science has changed over the years, letting us peer into the past and reflect on 70 years of the Society. In addition to being a celebration of soil science, this is also an opportunity to celebrate and reflect upon the British Society of Soil Science itself and its two journals.

The origin of the Society can be traced back to 1947, but it wasn't until 1950 that the *Journal of Soil Science*, as it was known in those days, was established. Trawling through the early articles provides insight into some fascinating topics; however, some effort is involved because, unlike today, there is no accessible electronic version of these papers. It is striking that the majority were published by single authors and mostly from the United Kingdom; notably, researchers from Rothamsted were influential in establishing both the Society and the Journal. Some fascinating research was described in those early papers, which often provided the foundations to our current day understanding of soil science. For example, work by Penman (1950) describes the dependence of transpiration on weather and soil conditions. This and subsequent work conducted at Rothamsted advanced much of our understanding of soil–water relationships. The early articles in the Journal had a strong focus on understanding fundamental processes in soil, its formation, the classification of soil

types and description of chronosequences. There was a noticeable absence of contemporary larger scale strategic problems that inspire much of our current research as well as little consideration of interactions between plants and soil, or with soil biology. Over the years the journal has had many loyal authors. For example, R. Webster has published 59 papers in our journals and it is therefore more than fitting that he was invited to contribute to the anniversary issue and share his views on the importance of analyses that fit the experimental design. Ensuring the rigour of analyses of results has always been one of the pillars of EJSS.

In the invited papers in this issue of EJSS and the December issue of SUM, a number of core themes emerge: climate and pedogenesis, carbon and organic matter; nutrient cycling, water and environment, soil biota, soil regional databases and methodological papers on statistical approaches and the importance of long-term experimentation. The types of papers also reflect more the modern approach of the Journal and include commentaries, opinions, reviews and original research.

Soil carbon research has, rightly so, been a constant theme in soil science. One of the first issues already contained a review of soil C research opening with a statement that not much has changed since 1938. I think we can confidently state that is no longer the case! Smith *et al.* (2018) remind us how soil organic matter has been at the core of British Society of Soil Science interest for at least the last 70 years and predicts this will continue to dominate our agenda with carbon central to so many of the issues, not only related to climate, that we face. Indeed, Minasny & McBratney (2018a) investigated if available water capacity can be increased with an increase in soil organic carbon, reminding us of the interconnectedness of soil issues. They concluded that the increase is negligible, but as debated in letters to the editor by Bouma and a response by these authors the outcome might be different if we use process-based models to characterize moisture availability to plants (Bouma, 2018; Minasny & McBratney 2018b). In the context of the 4 per mil initiative, it is clear that more work is still required to quantify the importance of soil C in ecosystem functioning.

Nutrients in soil remain a dominant topic in the literature, and new insights are still emerging. Several of the papers explicitly address phosphorus, perhaps an interesting reflection of a possible shift in interest between nutrients in recent years. The commentary by Haygarth *et al.* (2018) reflects on the important yet, so commonly neglected, organic compounds and organic phosphorus, which is interestingly also mentioned in the papers by Turner *et al.* (2018) and Bauke *et al.* (2018). Two further papers explore the relationship between nutrients and water related issues, with Boitt (2018) considering the phosphorus cycle but approached more from the perspective of irrigation in New Zealand, whilst Harris *et al.* (2018) consider the effect of drainage on plant community, and C and N cycling in permanent grassland. The importance of these interactions is resonated in a paper in SUM by McDowell (2018) who analysed data from a 6-year study and demonstrated that variable-rate irrigation decreased nutrient leaching losses of intensively grazed dairy pastures and advocates that wider adoption could decrease farm leaching losses compared to other irrigated areas.

One of the greatest advances of soil science over the decades is that we can now see what is below our feet through genetic, imaging and biogeochemical techniques coupled with powerful computational techniques. The exponential development of genetic tools to extract and analyse DNA and RNA from soil has revolutionized our understanding of soil biodiversity. Young & Bengough (2018) present a critical opinion on this when considering the importance of the physical habitat highlighted in soil microbiology studies. They advocate that a functional understanding of biodiversity rather than a 'biology of numbers and differences' approach should be followed. This provokes us to question, where has the 'molecular revolution' taken soil science in recent years and how can we best capitalize on this?

A second major advance, but one that comes naturally as a discipline evolves with time, is the large amount of data that we currently have, either obtained systematically or present as a collective body of published papers. Making use of data and knowledge to support

decision-making is at the heart of the paper in SUM by Hallett *et al.* (2017) who present three examples of the use of Land Information Systems, drawing from the LandIS system for England and Wales and the World Soil Survey Archive and Catalogue (WOSSAC). Land Information Systems support environmental interpretations, drawing on soil and related data, and offer insight into land capabilities. Orgiazzi *et al.* (2018) present a very contemporary regional approach to harmonized open access of soil datasets across Europe.

Arguably, most fitting in a reflective anniversary issue is the presence of a number of opinion or review papers, most notably with a consideration of the importance of statistical approaches (Webster & Lark, 2018) and of long-term experimentation (Johnston & Poulton 2018). Long-term studies are also key methodologies that underpin the papers by Boitt *et al.* (2018) and Bauke *et al.* (2018), reminding us of the importance of these investments.

As a parting reflection, the paper by Turner *et al.* (2018) provides a fundamental reminder of how climate affects soil development and pedogenesis, with an interesting link to nutrient availability. This paper takes us back in many ways to the fundamental principles of soil science that pre-date the 70 years of this celebration issue, with a reminder of the basic soil forming factors: climate, organisms, relief, parent material and time. Indeed, looking back through the papers offered here today, these core soil forming factors are still very present and cut across all these papers.

A profile of soil research that has evolved over time, but a profile that remains firmly based on the foundations of 70 years ago.

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