Soil Use and Management

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Introduction to the special Section 'Applications of electromagnetic induction to digital soil mapping'

In general terms, the most effective soil use and management outcomes will be developed by farmers and land managers if they have sufficient information about the spatial distribution of soil type and properties. However, this task is made particularly difficult by the fact that the soil is a complex medium of biological, chemical, physical and hydrological properties that all interact with one another. Furthermore, the cost of obtaining the data is both time-consuming and expensive. Establishing an appropriate sampling protocol to characterize this variation is also problematic.

To assist with locating suitable sampling sites and to add value to the limited soil information that can be collected, the use of electromagnetic (EM) induction instruments has been increasing. This is because they are proximal sensors that do not require physical contact with the soil. They are also relatively easy to use and make mobile. In addition, they measure the apparent soil electrical conductivity (EC_a), which is a function of chemical (e.g. mineralogy or salinity), physical (e.g. clay content) and hydrological (i.e. water) properties.

This special section within *Soil Use and Management*, which will be featured in each of the remaining issues of this Anniversary volume, contains the first collection of papers based upon the use of EM instruments and EC_a data to provide information about the spatial variation in soil properties and with a focus on how the information is used to improve and enhance soil use and management outcomes at the field, farm and district level.

Here, Corwin and Lesch demonstrate how ECa data collected at the field scale can be used to predict soil salinity from a universal calibration developed across a much larger spatial extent and across a large area in California's Coachella Valley. Their analysis provides a means of minimizing errors and account for spatial variation at finer scales.

In the first of two papers, Huang *et al*. describe a two-dimensional inversion approach in the context of a centre-pivot irrigation system located in San Jacinto in southern California. Over a period of 12 days, time-lapse imaging of soil water content is showcased which shows how water infiltrates and then is extracted after a single irrigation event. In their second paper, Huang *et al*. describe a three-dimensional inversion approach using a DUALEM-1 to map the extent of dryland salinity in a wheat field situated down a catena and in a semi-arid landscape near Merredin in Western Australia.

Soil use and management also requires information at larger scales and across areas where land degradation, such as soil salinization, occurs beyond individual fields and farm gates. Buchanan *et al*. provide an example that demonstrates how EC_a data, acquired across a highly productive irrigated agricultural landscape, can be used to characterize rootzone salinity (EM38) as well as groundwater depth (EM34) in association with other remote sensed data. An approach to understand the errors associated with making maps of soil properties is also provided and in terms of mapping topsoil CEC at a large scale.

We look forward to bringing you another tranche of papers in the next edition. In the meantime, we hope you enjoy reading these papers and that they stimulate discussion with your peers and colleagues about how these approaches could be used to enhance soil use and management in your part of the world.

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