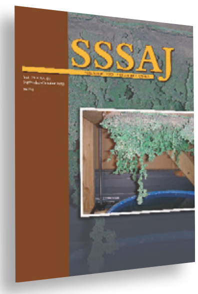
Society Science



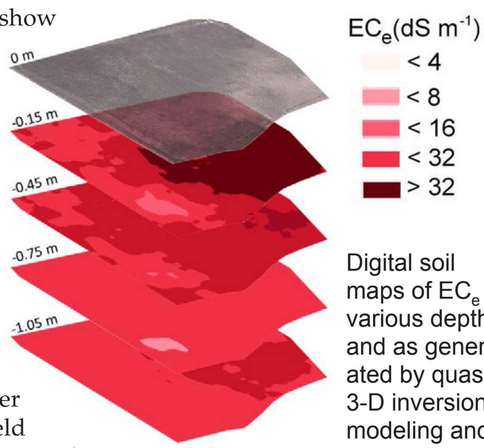
Modeling Salinity in Three Dimensions using Electromagnetic Inversion

A variable climate and unique geology has made the Australian continent susceptible to salinization. In the case of irrigation, the injudicious location of water storages and conveyance channels has often led to the mobilization of salts.

In the November–December 2015 issue of the *Soil Science Society of America Journal*, researchers report on the use of a multiple-coil electromagnetic (EM) instrument (DUALEM-421) and EM inversion software (EM4Soil) to develop 3-D maps of soil salinity.

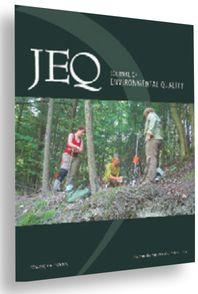
The team found that by collecting DUALEM-421 data along 13 transects and spaced 50 m apart, detailed 3-D models of the true electrical conductivity (σ) could be modeled. When σ was calibrated against laboratory-measured electrical conductivity of a saturated soil paste extract (EC_e), the single calibration equation could be used to estimate EC_e across the entire field and at any depth.

The results show that predicted EC_e allows causes and management of secondary soil salinity to be understood. For example, the inverted nature of salinity near the southeast corner of the study field and its proximity to the storage reservoir leads to the creation of a shallow saline water table. To manage salinity, one approach is to re-engineer the water storage and/or lay down a bentonite curtain. The maps can, therefore, act as baseline data, which can be used to determine the effect of these strategies.



Digital soil maps of EC_e at various depths and as generated by quasi-3-D inversion modeling and calibration of DUALEM-421 data using EM4Soil software. Note: Top layer is air-photo of study field.

Adapted from Zare, E., J. Huang, F.A. Monteiro Santos, and J. Triantafilis. 2015. Mapping salinity in three dimensions using a DUALEM-421 and electromagnetic inversion software. Soil Sci. Soc. Am. J. 79:1729–740. View the full article online at www.dx.doi.org/doi:10.2136/sssaj2015.06.0238



Chloride Outputs in Tile-drained Watersheds Respond Quickly to Inputs

Chloride is typically viewed either as a conservative tracer in biogeochemical studies or a contaminant from road salt runoff in urban areas. But farm fields also often receive large chloride inputs from applications of potash, a common potassium fertilizer. However, limited research exists on chloride balances and fluxes in agricultural watersheds.

In a recent, open access study in the *Journal of Environmental Quality*, researchers estimated long-term chloride inputs and measured tile and riverine outputs of chloride in two tile-drained agricultural watersheds, one with a larger area of urban land use. In both watersheds, fertilizer chloride was the dominant input (~49 kg ha^{-1} yr^{-1}), with road salt being the other major source: 23.2 and 7.2 kg ha^{-1} yr^{-1} in the Embarras and Kaskaskia watersheds, respectively.

Although chloride concentrations could be quite high in urban drainage areas in the Embarras watershed following snowmelt events, they didn't persist for long and were quickly diluted downstream. The study also found that Embarras River chloride concentrations increased during the 1960s and 1970s, concomitant with potash use in Illinois, and continued to respond varying potash inputs through 2014 with a lag of about two to six years.

Lead author Mark David sampling the Kaskaskia River for chloride and other water quality parameters during a very high flow event in 2013.

These chloride results for tile-drained watersheds suggest that riverine nitrate, important to water quality, would also respond quickly to changes in fertilizer N use. Part of the response in chloride (and likely nitrate) is due to recent (within one year) management and weather, with rapid transport from the root zone. Long-term changes (two to six years), meanwhile, likely result from the response of the shallow ground water pool.

David, M.B., C.A. Mitchell, L.E. Gentry, and R.K. Salemme. 2016. Chloride sources and losses in two tile-drained agricultural watersheds. J. Environ. Qual. 45(1). View the full open access article online at http://dx.doi.org/doi:10.2134/jeq2015.06.0302