Science Societies

President's pick: SSSA Research August 2026

By Aaron Lee M. Daigh

July 27, 2026

EM-induced bio-clogging: Formation evolution and permeability response under variably saturated flow

Spatial and vertical distribution of redox-sensitive elements and their controlling factors in deep soils under contrasting land cover in the Gulf Coastal Plains

Exciting new research is shared every day among the scientific community in our journals. SSSA is the sole publisher of the Soil Science Society of America Journal and Vadose Zone Journal, and co-publisher of the Journal of Environmental Quality and Agricultural & Environmental Letters with CSSA and ASA.

Each month, I will pick one or two articles among our journals that represent some of the most exciting, creative, and innovative research in our field of soil science. This month, I have chosen the following two articles from *Vadose Zone Journal.* Congratulations to the authors and thank you for sharing your excellent work!

EM-induced bio-clogging: Formation evolution and permeability response under variably saturated flow

When farmland drainage is infiltrated to recharge groundwater through soil aquifer treatment systems, the microbes that help clean the water can also clog the soil, and this study tracks how that clogging develops over time. Using an effective microorganisms consortium in sand columns under variably saturated flow, the authors show that permeability does not decline to a single stable value. It moves through three phases, a rapid drop as free cells occupy the large pores, a mid-term rebound and slow readjustment as biofilms mature, and a long-term dynamic equilibrium near 4.3% of the starting conductivity. In a counterintuitive result, moderately unsaturated soil promoted more microbial growth and extracellular polymeric substance (EPS) accumulation than fully saturated soil, and the clogging was stratified, with bacterial cells dominating the aerobic near-surface zone and EPS occluding the micropores below. From that pattern the authors suggest that operating soil aquifer treatment systems under unsaturated flow rather than fully ponded conditions may distribute clogging more evenly and extend their operational life.

Authors: Y. Chen, Z. Sang, G. Zhang, H. Li, Z. Pang, and Y. Tian

Journal: *Vadose Zone Journal*

Article link: https://doi.org/10.1002/vzj2.70117

Spatial and vertical distribution of redox-sensitive elements and their controlling factors in deep soils under contrasting land cover in the Gulf Coastal Plains

Most vadose zone redox studies stay within the root zone and presume that once a redox-sensitive element leaches below it, the element behaves as a conservative tracer until it reaches groundwater. This study makes a strong case that the deep vadose zone is far more biogeochemically active than that presumption allows. Across four contrasting sites along the Brazos River in Texas, from upland pasture to coastal salt marsh, the authors measured the distribution of iron, manganese, sulfate, nitrate, and phosphate down to 15 meters. Wetting and drying strongly controlled the redox chemistry. Fluctuating saturation repeatedly cycled iron between its oxidized and reduced forms, and because phosphate is sorbed to iron oxyhydroxides, those cycles released phosphorus, letting a deep soil shift from a nutrient sink to a nutrient source depending on recent moisture. The coupling was sharpest at the waterlogged marsh site, where reducing conditions elevated iron, sulfate, and phosphate together. The authors paired field cores and laboratory analyses with machine-learning attribution (Random Forest and Shapley Additive Explanations) and reactive transport modeling in PFLOTRAN, which reproduced the finer-textured lowland sites well but was inconclusive for the shrink-swell Vertisols. Their results emphasize the need to fold hydrological fluctuation into how deep subsurface redox is studied and modeled.

Authors: A. Sedaghatdoost and B.P. Mohanty

Journal: *Vadose Zone Journal*

Article link: https://doi.org/10.1002/vzj2.70123

Vadose Zone Journal

Back to issue

More science

Text © . The authors. CC BY-NC-ND 4.0. Except where otherwise noted, images are subject to copyright. Any reuse without express permission from the copyright owner is prohibited.