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Introduction

Revitalizing pedology through hydrology and connecting hydrology to pedology

Is pedology dying, thriving, or just changing? In our view, the emphasis of pedology is now shifting from classification and inventory to understanding and quantifying spatially and temporally variable processes upon which the water cycle and ecosystems depend. Since pedologists study soils in their natural landscape settings and focus on in situ soil characteristics, their spatial diversity, and their relations to the landscape and land use, pedological expertise and databases have valuable contributions to the study of the hydrologic cycle. Field reality, such as soil heterogeneity, layering, aggregation, shrink–swell, and occurrences of various macropores, often makes classical soil physical and hydrological models too simplistic or invalid. In this regard, pedology has a unique role to play.

In recognition of growing synergies that can be generated by bridging traditional pedology with soil physics and hydrology, a symposium on "*Hydropedology: Bridging Disciplines, Scales, and Data*" was held during the annual meeting of the Soil Science Society of America (SSSA) in Nov. 3–5, 2003, Denver, Colorado. The goals of this symposium were two-fold: 1) to bring together current research along with synthesis of the state-of-the-art knowledge on hydropedology; and 2) to provide a forum for stimulating future development of hydropedology. The symposium brought together a good mix of pedologists, soil physicists, hydrologists, and others to explore why and how hydropedology could be promoted as an intertwined branch of soil science and hydrology that embraces interdisciplinary and multiscale studies of interactive pedological and hydrological processes and their properties in the earth's critical zone. There were a total of 34 invited and volunteered oral and poster presentations, from which 10 were selected for publication in this special issue. At the end of the symposium, a panel discussion (with panelists Johan Bouma, Christopher Duffy, Rien van Genutchen, and Larry Wilding) generated considerable interests among peers.

The first part of this publication includes two keynote papers providing overviews of relevant topics. The first one by Wilding and Lin suggests the unique role hydropedology can play in advancing the frontiers of soil science towards a geoscience. The second one by Bouma highlights the powerful potential of hydropedology in environmental policy research and interdisciplinary teams dealing with land use through several convincing examples. The second part covers methodologies or perspectives on the potential for hydropedology to improve hydrologic modeling, pedotransfer functions, and interpretations of ground penetrating radar (GPR) data. The paper by Vepraskas, Huffman, and Kreiser shows how hydrologic models can be used to quantitatively relate water table fluctuations to percentages of redox depletions in wetland soils. Bryant, Gburek, Veith, and Hively present aspects of hydropedology that can be used to enhance watershed modeling of phosphorous loss to surface water bodies. Pachepsky, Rawls, and Lin discuss the relationship between the structure and hydrologic function of soil pore space by presenting

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an example from the U.S. National Cooperative Soil Survey database. Doolittle, Jenkinson, Hopkins, Ulmer, and Tuttle examine the potentials and limitations of GPR for water table and ground water flow investigations in coarse-textured soils. The third part of this special issue consists of four papers dealing with case studies. Gburek, Needleman, and Srinivasan demonstrate how soil mapping of fragipan conditions can enhance the ability to portray a watershed's total hydrologic performance. Lin, Kogelmann, Walker, and Bruns illustrate that the understanding and modeling of soil moisture patterns in a forested catchment can be improved through sufficiently detailed soil mapping and identification of lateral flow at the hillslope scale. Corwin, Lesch, Oster, and Kaffka characterize management-induced spatio-temporal changes in soil physical and chemical properties through soil sampling directed by geospatial electromagnetic induction measurement of apparent electrical conductivity. Finally, Costantini, Pellegrini, Vignozzi, and Barbetti investigate the internal drainage of twelve soils in vineyards and olive groves and show that seasonal soil water content and redox potential were related to the micromorphological estimation of hydromorphic degree.

The symposium was sponsored by the Division S-5 (Pedology) of the SSSA and the ACS 837 Hydropedology Working Group, with co-sponsorship from the Divisions of S-1 (Soil Physics), S-3 (Soil Biology), S-7 (Forest Soils), S-9 (Soil Mineralogy), S-10 (Wetland Soils), and S-11 (Soil and Environmental Quality) of the SSSA and the Divisions of A-5 (Environmental Quality) and A-8 (Integrated Agricultural Systems) of the Agronomy Society of America. We would like to acknowledge the support provided by Drs. Mickey Ransom, Tom Sims, Dani Or, and Helga van Miegroet, who helped make this symposium possible. We thank all presenters and participants of the symposium, without them this symposium would not have been meaningful. We also appreciate the Editors-in-Chief of *Geoderma* and Judith Taylor of Elsevier for their support of publishing this special issue.

We would like to note that we honored Dr. Larry P. Wilding's career in conjunction with this symposium. After an impressive career at The Ohio State University and Texas A&M University, Larry retired in January 2003. His interest and appreciation of pedology–hydrology interface have inspired many of his students and colleagues.

We are grateful to the following 23 reviewers who donated their valuable time and professional insights that helped ensure the quality of all the manuscripts submitted to this special issue: Robert Ahrens, Richard Arnold, Francois Bartoli, Randy Brown, Ray Bryant, Nancy Cavalloro, Dennis Corwin, Jacob Dane, James Doolittle, Daniel Gimenez, Cindy Johnson, Tuomo Karvonen, Edward Landa, Phil Meyer, Anthony O'Geen, Marty Rabenhorst, Mark Stolt, Les Ternan, Remke van Dam, Marnik Vanclooster, Mike Vepraskas, Andrew Western, and Henk Wösten.

The papers collected in this special issue present the state-of-the-practice relevant to hydropedology, and suggest a shift of geology-rooted classical pedology to a hydrology-driven approach with a landscape perspective. We hope that, through this initiative, the potential of hydropedological perspective and approaches can be further realized in the near future.

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