



SWES SOUNDS

THE UNIVERSITY OF
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COLLEGE OF AGRICULTURE
AND LIFE SCIENCES

The Heartbeat of the Department of Soil, Water & Environmental Science

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TONES FROM THE TOOTH

October 2009

A popular bumper sticker admonishes us all to "Save the Planet". In terms of "Earth Time" (aka geological time) I have confidence that Planet Earth will survive any disturbances we see taking place today just fine. The living creatures on Earth are the components most in question and human beings are probably among the most vulnerable. Thus, the bumper sticker in question perhaps should read "Save the People".



Human existence creates an impact on the full range of environments (native, agricultural, industrial, and urban) that we live in. Our existence and the ability of future generations to exist will depend on our capacity for understanding and managing these systems in a sustainable manner.

Environmental science involves our efforts to better understand the impacts of human existence on the environment in which we live (and depend) and how we can better manage all systems in an environmentally sound and sustainable manner. One can review the areas of study in the SWES Department and recognize the connection in each area to human activity and environmental impact. Our general areas of focus and strength, Critical Zone Science and Water Quality are very good examples.

It is good for us all to think about how we define and apply a functional concept of environmental science to our work in this department and more importantly what we offer to the effective management of our immediate environments and our land and water resources. The application of good environmental science information is good for us all and good for "saving the planet" as well.

Jeffrey C. Silvertooth, Department Head

Featured Visiting Scholars

Nicole Emerstorfer

I am a visiting research scholar from the University of Natural Resources and Applied Life Sciences (BOKU) in Vienna, Austria, where I recently defended my PhD in Soil Physics. I am in Tucson for the second time this year. During my first visit at the SWES Department from March to June, I completed my PhD Thesis on "Quantifying Effects of Rock Fragments on Soil Hydraulic Properties and Groundwater Recharge by Means of Field Measurements and Numerical Modeling" under the supervision of Markus Tuller. After successfully defending my PhD in Austria, Markus offered me an opportunity to return to the SWES Department to work on the application of high-resolution thermal imaging and heat pulse technology for the prediction of evaporation rates from soils.

In my former life I studied landscape architecture. Upon completion of my Masters degree, I participated in a three-month internship at the Research Center CEMAGREF in Montpellier, France to work on direct planting techniques of irrigated winter crops under Mediterranean conditions. After returning to Austria, I accepted a research assistant position at the Department of Hydraulics and Rural Water Management at BOKU.

I am happy to be back in Tucson, enjoying the sun and of course working in Markus's group.

Carlos M. P. Vaz

I am visiting research scholar from the Agricultural Instrumentation Center of the Brazilian Agricultural Research Corporation (EMBRAPA) in São Carlos, Brazil, spending a 12-month sabbatical with Markus Tuller and his group. I came to Tucson with my wife Rosinea, daughters Bruna and Júlia and my son Gabriel.

I have a bachelor degree in Physics and obtained MSc and PhD degrees in Soil Physics and Environmental Science, all from the University of São Paulo (USP). I have been working for EMBRAPA since 1989. My main interests lie in the

development of simple and advanced methods for soil physical laboratory and field characterization, for both basic research and practical soil management and conservation purposes.

My joint project with Markus is focused on the application of micro X-Ray CT for quantification of water retention and soil pore and aggregate distributions. We also work on the characterization of particle size distribution at the sub micron scale with laser diffraction and atomic force microscopic techniques.

I am grateful that my family and I have the opportunity to spend time in Tucson and work in the SWES Department.

DEPARTMENT NEWS:

Be sure to see Dr. Ryan Sinclair and the SAGE Project video at <http://uanews.org/> at U of A news on "Safeguarding the Water Supply". This video highlights the work done at the Water Village on the development of real time sensors for water distribution systems.

A new version of the Proposal Routing Sheet (PRS) is posted: <http://www.sps.arizona.edu/proposal/proposalroutingsheet.htm> This change is in response to the new Conflict of Interest Policy, located at: <http://www.vpr.arizona.edu/conflict-of-interest> (effective July 1, 2009). On page 2 of the PRS, the following question appears for PIs/Co-PIs: "Have you filed a Report of Financial Interest with the OVPR?" The Report of Financial Interests Form is required for each proposal, and each investigator listed on a proposal. Send the completed/signed Report of Financial Interests forms to coi@email.arizona.edu (not to Sponsored Projects). If you have questions about the COI policy, please contact Mary Lovely at 626-7879, or lovely@email.arizona.edu. Please download and start using the new proposal routing sheet. It will be required as of **September 1, 2009**.

GRADUATE STUDENT NEWS:

Luisa Ikner (Gerba) was selected as one of ten graduate fellows for the 2009-2010 National Science Foundation/BIO5 BioME Program (Stipend: \$30,000). She is working with 7th grade science students from Flowing Wells Junior High to foster hands-on inquiry-based skills while encouraging critical thinking in modern science and technology issues.

Matt Levi (Ph.D., Rasmussen) recently had his first peer-reviewed journal article accepted by the Soil Science Society of America Journal. This manuscript presents data from his Master's research at Auburn University. **Levi, M.R.**, J.N. Shaw, C.W. Wood, S.M. Hermann, E.A. Carter and Y.Feng.

200X. Land management effects on near-surface soil properties of Southeastern U.S. Coastal Plain Kandiodults. Soil Sci. Soc. Am. J. In Press

SWES REPORT CARD:

GRANTS:

J. Chorover (SWES), P. Troch (HWR), **C. Rasmussen** (SWES), P. Brooks (HWR), J. Pelletier (GEOS), **M. Schaap**, K. Lohse, S. Kurc, T. Meixner, J. McIntosh, D. Breshears and T. Huxman. Transformative Behavior of Energy, Water and Carbon in the Critical Zone: An Observatory to Quantify Linkages Among Ecohydrology, Biogeochemistry and Landscape Evolution. National Science Foundation, Earth Sciences Division. \$4.35M/ five years.

K. Lowe (P.I.), T. DiChristina, A. Murphy, M. Perseans, and **C. Rensing**. URM: Undergraduate Research and Mentoring at a Hispanic Serving Institution: Investigating a rare ecosystem. 2009-2013, NSF \$768,552.

M. Tuller, **P. Iassonov**, and **M.G. Schaap**, Development of Efficient X-Ray CT Image Segmentation Techniques for Quantitative Analysis of Phase Distributions and Flow Processes in Porous Media. NSF-EAR Hydrological Sciences, \$249,820.

M. Tuller and S.B. Jones. A Novel Approach to Quantifying Soil Evaporation Rates with Resolution Thermal Imaging and Heat Flux Measurements. CSREES AFRI Soil Processes, \$448,600.

PUBLICATIONS:

Allen, G., S. Fielder, **K. Fitzsimmons**, S. Applebaum, and S. Raizada. 2009. Chapter 36. Inland saline aquaculture. pp. 1119-1147. In: Burnell, G. and Allen, G. (eds). New Technologies in Aquaculture. CRC Press and Woodhead Publishing.

Deng H., M. Ye, **M. G. Schaap**, R. Khaleel. 2009, Quantification of uncertainty in pedotransfer function-based parameter estimation for unsaturated flow modeling, Water Resour. Res., 45, W04409, doi:10.1029/2008WR007477.

Heinse, R., S.B. Jones, **M. Tuller**, G.E. Bingham, I. Podolskiy, and D. Or. 2009. Providing Optimal Root-Zone Fluid Fluxes:

Effects of Hysteresis on Capillary-Dominated Water Distributions in Reduced Gravity. SAE Technical Paper No. 2009-01-2360.

Iassonov, P., T. Gebrenegus, and M. Tuller. 2009. Segmentation of X-ray computed tomography images of porous materials: A crucial step for characterization and quantitative analysis of pore structures. *Water Resour. Res.*, doi:10.1029/2009WR008087.

Kim, M., S. A. Boone and C. P. Gerba. 2009. Factors that influence the transport of *Bacillus cereus* spores through sand. *Water, Air and Soil Pollution*. 199:151-157.

Qazi, M.A., M. Akram, N. Ahmad, J. F. Artiola, and M. Tuller. 2009. Economical and environmental implications of solid waste compost applications to agricultural fields in Punjab, Pakistan. *Waste Management*, 29(9): 2437-2445.

Quaranta, D., M.M. McEvoy, and C. Rensing. 2009. Site Directed Mutagenesis Identifies a Molecular Switch Involved in Copper Sensing by the Histidine Kinase CinS in *Pseudomonas putida* KT2440. *J. Bacteriol.* 16: 5304-5311.

Megdall, S. Concise vision needed for water. *Arizona Republic* My Turn, August 25, 2009.

Megdall, S. AZ water planning, a glass both half filled and half empty. *Arizona Water Resource*, Summer 2009.

Gerlak, A., S. Eden, S. Megdall, K. Mott Lacroix and A. Schwarz. Restoration and river management in the arid southwestern USA: exploring project design trends and features. *Water Policy* 11 (2009) 461-480.

Nelson, S.G., E.P. Glenn, D. Moore, and B. Ambrose. 2009. Growth and Distribution of the Macroalgae *Gracilaria salicornia* and *G. parvispora* (Rhodophyta) Established from Aquaculture Introductions at Moloka'i, Hawai'i. *Pacific Science* 63:383-396.

Porter, M.L., M.G. Schaap, and D. Wildenschild. 2009. Lattice-Boltzmann Simulations of the Capillary Pressure-Saturation - Interfacial Area Relationship in Porous Media. Accepted by *Advances in Water Resources Research* June 23, 2009.

J. F. Artiola, and M. Tuller, 2009. Economical and environmental implications of solid waste compost applications to agricultural fields in Punjab, Pakistan. *Waste Management*, 29(9): 2437-2445.

Quaranta, D., M.M. McEvoy, and C. Rensing. 2009. Site Directed Mutagenesis Identifies a Molecular Switch Involved in Copper Sensing by the Histidine Kinase CinS in *Pseudomonas putida* KT2440. *J. Bacteriol.* 16: 5304-5311.

Sinclair, R. G., P. Romero-Gomez, C. Y. Choi and C. P. Gerba. 2009. Assessment of MS-2 phage and salt tracers to characterize axial dispersion in water distribution systems. *Journal of Environmental Science and Health* 44:963-971.

Wang T., V. A. Zlotnik, J. Šimuněk, M. G. Schaap. (2009). Using pedotransfer functions in vadose zone models for estimating groundwater recharge in semiarid regions. *Water Resour. Res.*, 45, W04412, doi:10.1029/2008WR006903.

Zachritz II, W. H., A. T. Hanson, and K. M. Fitzsimmons. 2009. Application of Vegetated Submerged Bed Constructed Wetlands in Recirculating Tilapia Production Systems. *Aquacultural Engineering* 39(1):16-23.

PRESENTATIONS:

Byrne, A., A. Legatzki, M. Ortiz, and R.M. Maier. Identifying and characterizing microbes found on formations in Kartchner Caverns. Undergraduate Biology Research Program Summer Poster Session. UA, Aug. 6.

Gerba, C. P., instructor at the fourth Annual Workshop on Quantitative Microbial Risk Assessment held at Michigan State University, East Lansing August 16-20.

LaComb, M., J.W. Neilson, and R.M. Maier. Comparative diversity of two hyper-arid regions of the Atacama Desert, how similar are they? Undergraduate Biology Research Program Summer Poster Session. UA, Aug. 6.

Legatzki, A., M. Ortiz, J.W. Neilson, M. Creamer, K. Nelson, H.Th. Chu, C.E. Banczak, B.M. Pryor, L.S. Pierson III, and R.M. Maier. Microbial diversity in Kartchner Caverns, a carbonate cave in southern Arizona, US. 15th International Congress of Speleology, Kerrville, TX July 19-26.

Maier, R.M. Characterization and reclamation of mine tailings in the desert Southwest. Arizona State Mine Inspector Fall Mine Mixer Conference, Oct. 1.

Megdall, S. The US-Mexico Transboundary Aquifer Assessment Program: The Arizona-Sonora Portion as a Case Study. Sharing an Invisible Water Resource for the Common Good: How to Make Use of the UN General Assembly Resolution on the Law of Transboundary Aquifers Seminar, World Water Week, Stockholm, Sweden, August 20.

Megdall, S. Challenges to Sustainable Water Management. Udall Foundation Scholars Orientation, Tucson, August 7.

Neilson, J.W., L.A. Ikner, R.R. Casavant, R.S. Toomey, G. Nolan, R.M. Maier, and E. Cook. Monitoring of microbial populations in Kartchner Caverns State Park - a cost-effective cave management and outreach strategy. 15th International Congress of Speleology, Kerrville, TX July 19-26.

Pepper, I. Soil and Biosolids: Public Health Threat or Savior. And Sustainability and Pathogen Hazards of Land Application of Class B Biosolids in the United States. 12th IWA Sludge Conference - Sustainable Management of Water and Wastewater Sludges. Harbin China, August 8-10.

Pepper, I. Future Water. Arizona Water Reuse 2009 Conference. Flagstaff, AZ, July 30-31.

Pepper, I. Soil and Biosolids: Public Health Threat or Savior? Biosolids & Reclaimed Water Workshop. Seattle, WA, July 16.

Schaap, M.G., M.L. Porter, D. Wildenschil. Lattice-Boltzmann Simulations of Pressure, Saturation, and Interfacial Area in Porous Media. Invited talk at the inaugural meeting of the INTERPORE society. Kaiserslautern, Germany, March 11-14.

Schaap, M.G., M. Tuller, A. Guber, and Y. Pachapsky. Lattice Boltzmann Modeling of Macro-Porous Flow: Effects of Image Segmentation Algorithms and Comparisons with Observed Data. Invited talk in MS55, SIAM Activity Group on GeoSciences. Leipzig Germany, June 15-18.

Schaap, M.G., M.L. Porter, D. Wildenschild. Interfacial Area, Capillary Pressure and Saturation at the Pore-scale: Observations and Lattice Boltzmann Simulations. Invited talk in MS59, SIAM Activity Group on GeoSciences. Leipzig Germany, June 15-18.

Schaap, M.G., D. Wildenschild, M.L. Porter and B.S.B. Christensen. Lattice Boltzmann modeling of pore-scale interfaces. 3-hour invited lecture in: Role of Interfacial Area in Two-Phase Flow and Transport in Porous Media: Theory, Experiment, Modelling. Summer School, Utrecht University, July 19-24.

Silvertooth, J. The Confluence of Environmental Science and Agriculture. Department of Geosciences Earth Sciences Colloquium. Tucson, AZ, September 3.

Silvertooth, J. Leadership and Budget Management. UA New Heads Ed. Tucson, AZ, September 11.

Silvertooth, J. Agricultural water use in Arizona: Current conditions and future projections. Climate, Water and Land Cover Change in a Non-stationary World. SAHRA Annual Meeting. Tucson, AZ, September 23.

Silvertooth, J. Nutrient and Water Management. Chile Field Day, Curry Chile & Seed Co. Pearce, AZ, September 25.

Silvertooth, J. Factores de Agronomía Para el Desarrollo de Sistemas de Producción de Cultivos Sostenibles en Regiones Áridas. Primer Simposium Internacional de Agricultura

Ecológica. Obregón, Sonora, Mexico, September 30. Wickramasekara, S., S. Hernández Ruiz, L. Abrell, J. Chorover. Detection and quantification of EDC/PPCPs in source waters containing dissolved and colloidal organic matter. 2nd International Conference on Occurrence, Fate, Effects, and Analysis of Emerging Contaminants in the Environment. Colorado State University, Fort Collins, CO, August 4-7.

PLANE TALK FROM ERL

Ian Pepper



The Water Village now functions as a science and engineering center with a state, national and international reputation due to the state-of-the-art research that is conducted on various aspects of water and wastewater treatment and distribution. Over the next few "SWES Sounds" we will highlight some of this research.

One high profile project has involved the development of an assay to detect infectious prions. Normal prion proteins are found in the brains of humans and many other mammals including cows, sheep and mice, and have essentially a tertiary protein structure dominated by α helices. Abnormally folded prion proteins (β sheet tertiary structure) result in transmissible spongiform encephalopathies (TSEs) that cause a group of rare but fatal neurodegenerative disorders known as "mad cow disease" in cattle and Creutzfeldt-Jacob disease in humans—it's a scary disease. Our infectious assay for prions (the only such assay in the world) has allowed us to evaluate the fate of prions in water, wastewater and biosolids. Our studies have shown that "infectious" prions are not as stable as previously thought. This is because previous studies utilized "western blot" technology which detected the amino acid of the protein, but did not determine whether or not the protein was infectious. Hence we have shown inactivation of infectious prions in potable water and also during wastewater treatment. These studies have enormous public health implications. Chuck Gerba and Ian Pepper are the P.I.s on these projects; Kazue Takizawa obtained her M.S. degree based on this research; and Syreeta Miles is working on a PhD.

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### SWES Fall Chile Cookout --- 21 August 2009

Congratulations to the 2<sup>nd</sup> Annual Dessert Contest winner  
--**Marianyoly Ortiz-Ortiz**