



SWES SOUNDS

THE UNIVERSITY OF
ARIZONA
COLLEGE OF AGRICULTURE
AND LIFE SCIENCES

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

August/September 2011
<http://ag.arizona.edu/SWES/>

TONES FROM THE TOOTH

In the summer months, many people outside the university like to think that faculty, staff, and students have nothing to do but relax by the pool, drink Piña Colodas, and ponder the world philosophically. When I stop and think about it that sounds like a pretty good deal. But in truth, for departments like SWES, most folks are extremely busy through the summer putting science to work in real world applications in earth and environmental science. I was reminded of that this past summer during the course of my interactions with faculty, staff, and students in the department hearing about various projects and ongoing work.

A very important part of the programs in the SWES Department is the capacity to effectively apply conceptual knowledge to real issues and problems in the earth and environmental science arena, which includes agricultural applications. This application process is fundamental to a land-grant institution and our general mission. The interest and capacity to apply the science to real-world conditions is an important element that people in departments like SWES typically possess, as opposed to maintaining an interest only in the pursuit of science as a pure and esoteric exercise. That does not make us any better or worse than any other scientists. But the applied aspects are distinguishing features that are manifest in the nature of our research programs, our undergraduate and graduate curriculum, and our extension education programs.

The ultimate goal for most programs in departments like SWES is to provide information and technology that is practical and useful in our efforts to manage our air, land, and water resources appropriately and sustainably. Accordingly, our connection to society and the broader community that we serve is important. The summer months provide an excellent opportunity for the SWES Department to move programs forward and apply them. So people from SWES are commonly out in the "field" applying their trade and working with people in the communities we serve. That has been the case again over the past several months. At least that is what they tell me they are doing.

Jeffrey C. Silvertooth, Department Head



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Shantz Bldg. 38, Rm. 429 Tucson, AZ 85721

FEATURED RESEARCHER

Joost Van Haren – A former SWES graduate student, he currently is an assistant research professor at University of Arizona's Biosphere 2 center, where he leads the rainforest research. Joost (pronounced like "toast" with a Y) is originally from the Netherlands, where he did an undergraduate degree in geology. He moved to the U.S. in 1990 and completed a master's in 1995 at Yale University, where he worked on fluid flow in deep crustal environments. In 1995, he came to Tucson to take a position as a research specialist and laboratory manager at Biosphere 2. In 2004, after Columbia University terminated its contract with Biosphere 2's owner, he worked a year for the U.S. Department of Agriculture Southwest Watershed Research Center. He then started work at the UA on his Ph.D., which he completed last April. During his Ph.D. research, he received fellowships from the UA Wallace H. Fuller Fellowship, the UA Institute of the Environment, and the NSF-Amazon Partnership for International Research and Education in Amazon Climate Interactions.



Joost's current research focuses on how plants interact with soil bacteria. Soil bacteria naturally produce greenhouse gases like carbon dioxide (CO₂) and nitrous oxide (N₂O). This century, N₂O is projected to become the main cause for the destruction of the ozone layer, which protects us from the sun's ultraviolet radiation. During his research in the rainforest at Biosphere 2, Joost noticed that the soil fluxes of CO₂ and N₂O near sugar palms were consistently high. This made him wonder if roots of certain plants stimulate bacteria in the soil and, in this way, increase natural greenhouse gas production.

To test his hypothesis, Joost went to the real rainforest in the Amazon basin of Brazil. With the UA's Scott Saleska and a team of U.S. and Brazilian scientists, he managed several large forest plots. Using 15 especially large and abundant tree species to compare the CO₂ and N₂O production by soil bacteria, he found that, indeed, bacteria near certain tree species produce more N₂O than those near other tree species. He also discovered a positive connection between forest growth and N₂O flux to the atmosphere. His research findings help reveal how natural ecosystems contribute to the overall greenhouse gases in the atmosphere and how this contribution will change with future climate change.

In his current position, he continues with his research on plant-soil-microbe interactions, focusing on direct mechanisms that link trees to microbial activity. He also directs the research in the Biosphere 2 rainforest, where he will be conducting drought experiments to determine tree and ecosystem responses and relating them to how tropical ecosystems will respond to climate change.

CONGRATULATIONS

Corin Hammond, a doctoral student working with Jon Chorover, was the trainee highlight of the month in the "E-Posted Notes" sent out by the National Superfund Research Program. She is helping to develop a cost-effective phytostabilization strategy for the Iron King Mine-Humboldt Smelter Superfund Site.

Leif Abrell was selected as a 2011 International Union of Pure and Applied Chemistry Young Observer. She will present work at this year's IUPAC meeting in August.

Rose McAndrew, a student in the laboratory of **Mark Brusseau**, won the Hargis Award First Place Poster Presentation at the 2011 El Dia Del Agua.

The Water Sustainability Program announced the **Student Fellowship Awards** for 2012-13, with three SWES students receiving awards:

- **Monica Ramirez- Andreotta**, Ph.D. candidate, for *Gardenroots: A Citizen Science Program to Empower Communities Neighboring Contamination*. Advisors: Raina Maier, Janick Artiola, Mark Brusseau.

A highlight can be found at:

http://www.superfund.pharmacy.arizona.edu/news/EPA_Grant_Ramirez_Andreotta.php

- **Berenise Rivera**, Ph.D. candidate, for *Analyzing Water Samples for Sources of Contamination Using PCR and qPCR*. Advisor: Channah Rock.

- **Rachel Maxwell**, for *Detection and Quantification of EDC/PPCPs in Source Waters Containing Dissolved and Colloidal Organic Matter*. Advisor: Jon Chorover.

Chris Rensing was appointed as associate editor for *Frontiers in Microbiological Chemistry* and as adjunct associate professor at the University of Texas PanAmerican. Dr. Rensing was also featured in two UA articles:

<http://www.uanews.org/node/39791>

<http://www.uanews.org/node/40308>

Markus Tuller received the 2011 Award for Excellence in Recognition of Outstanding Contributions to Western Region Multistate Research from the Western Association of Agricultural Experiment Station Directors (July 2011).

Syreeta Miles, a former Ph.D. student with **Ian Pepper**, accepted a position with the Epidemiology Intelligence Service of the Centers for Disease Control. She will be stationed in Los Angeles.

Several students who had worked with **Charles Gerba** recently accepted positions upon completing their degrees:

- **Marcela Soto** accepted a position as a research scientist with the Clorox Company in Pleasanton, Calif. Her dissertation was on "Assessing efficacy of nanocream filters for virus concentration from water: Risk assessment for *Listeria* and *Salmonella* in food."

- **Lisa Casanova** accepted a position as an assistant professor of Environmental Microbiology at Georgia State University in Atlanta.

- **Sonia Fankem**, Ph.D., is working with Doctors Without Borders studying a cholera outbreak in Ethiopia.

- **Roberto Rodriguez**, Ph.D., is now a postdoctoral fellow in the Dept. of Civil and Environmental Engineering at Colorado University in Boulder.

- **Joan Rose**, Ph.D., was elected to the National Academy of Engineering.

- **Marylynn Yates**, Ph.D., was elected a fellow of the American Academy for Microbiology.

SWES REPORT CARD

GRANTS

Brusseau, M.L. Use of mass-flux measurement and vapor-phase tomography to quantify vadose-zone source strength and distribution. U.S. Department of Defense, Environmental Security Technology Certification Program. \$673,000.

Gerba, C.P., S. Maxwell and A. Tamimi. Assessment of a home hygiene intervention. The Clorox Company. \$38,000.

Rensing, Chris. Improving efficacy of various copper alloys toward various *Cronobacter* isolates and spores of *Clostridium Perfringens* and *Bacillus Cereus*. International Copper Association. \$20,000.

Schaap, Marcel. DOE-BES: A detailed study of the physical mechanisms controlling CO₂-brine capillary trapping in the subsurface (100% effort). \$363,420.

Schaap, Marcel. NRCS-DESU: Modifications of Rosetta-DM for interfacing NRCS soil databases and NDDRAIN Algorithms. \$12,851.

Tamimi, A. and C.P. Gerba. Bacterial occurrence in hand soaps in the Middle East. GOJO Company. \$5,000.

Tamimi, A. Assessment of the magna flow process for production of class A biosolids. Magna. \$70,000.

PUBLICATIONS

Alum, A., C. Enriquez and C.P. Gerba. 2011. Impact of drip irrigation method, soil, and virus type on tomato and cucumber contamination. *Food Environ. Virol.* 3:78-81.

Chattman, M., **S. L. Maxwell and C. P. Gerba.** 2011. Occurrence of heterotrophic and coliform bacteria in liquid hand soaps from bulk refillable dispensers in public facilities. *Journal of Environmental Health* 73(7): 26-29.

Curlango-Rivera, G., **M.C. Hawes.** 2011. Root tips moving through soil: an intrinsic vulnerability. *Plant Signaling and Behavior* 6(5): 1-2.

Difilippo, E. and **M.L. Brusseau.** 2011. Assessment of a simple function to evaluate the relationship between mass-flux reduction and mass removal for organic-liquid contaminated source zones. *Journal of Contaminant Hydrology.* 123: 104-113.

Elguindi, J., X. Hao, Y. Lin, H.A. Alwathnani, G.H. Wei, and C. Rensing. 2011. Advantages and challenges of increased antimicrobial copper use and copper mining. *Appl. Microbiol. Biotech.* 91: 237-249.

Gebrenergus, T., T. Ghezzehei, and **M. Tuller,** 2011. Physicochemical controls on initiation and evolution of desiccation cracks in sand-bentonite mixtures: X-Ray CT imaging and stochastic modeling. *Journal of Contaminant Hydrology*, doi: 10.1016/j.jconhyd.2011.07.004.

Gerba, C.P., A. Ross, K. Takizawa, and I.L. Pepper. 2011. Efficiency of ASTM method D4994-89 for recovery of enteric viruses from biosolids. *Food Environ. Virol.* 3:43-45.

Hawes, M.C., G. Curlango-Rivera, F. Wen, G.J. White, H.D. VanEtten, Z. Xiong. 2011. Extracellular DNA: the tip of root defenses? *Plant Science* 180: 741-745.

Mahal, M.K., A. Murao, **A. Russo, and M.L., Brusseau.** 2010. Nonideal behavior during complete dissolution of organic immiscible liquid. 1. Ideal Porous Media. *Water, Air and Soil Pollution.* 213: 191-197.

McEvoy, M.M., and C. Rensing. 2011. *Biometals* 2010 (Tucson, Arizona). *BioMetals* 24: 377-378.

Miles, S.L., K. Takizawa, I.L. **Pepper**, and C.P. **Gerba**. 2011. Survival of infectious prions in water. *J. Env. Sci. & Health. Part A.* 46:938-943.

Miles, S.L., R.G. Sinclair, M.R. Riley, and I.L. **Pepper**. 2011. Evaluation of select sensors for real-time monitoring of *Escherichia coli* in water distribution systems. *App. Environ. Microbiol.* 77: 2813-2816.

Resurreccion, A.C., P. Moldrup, M. **Tuller**, T.P.A. Ferre, K. Kawamoto, and T. Komatsu, and L.W. de Jonge, 2011. Relationship between specific surface area and the dry end of the water retention curve for soils with varying clay and organic carbon contents. *Water Resour. Res.*, 47, W06522.

Riley, M. R., C. P. **Gerba** and M. Elimelech. 2011. Biological approaches for addressing the grand challenge of providing access to clean drinking water. *J. Biological Engr.* 5(2):1-10.

Sakai, M., S.B. Jones, and M. **Tuller**, 2011. Numerical evaluation of subsurface soil water evaporation derived from soil thermal properties. *Water Resour. Res.*, 47: W02547.

Stine, S. C., I. Song, C. Y. Choi and C. P. **Gerba**. 2011. Application of pesticide sprays to fresh produce: a risk assessment for hepatitis A and *Salmonella*. *Food Envir. Virol.* 3:86-91.

Vaz, C.M.P, J.M. Manieri, I.C. de Maria, and M. **Tuller**, 2011. Modeling and correction of soil penetration resistance for varying soil water content. *Geoderma*, doi:10.1016/j.geoderma. 2011.07.016.

Xiong, J., D. Li, H. Li, M. He, S.J. Miller, L. Yu, C. **Rensing**, and G. Wang. 2011. Genome analysis and characterization of zinc efflux systems of a highly zinc-resistant bacterium, *Comamonas testosteroni* S44. *Res. Microbiol.* 162: 671-679.

Zapka, C.A., E.J. Campbell, S.L. **Maxwell**, C.P. **Gerba**, M.J. Doyle, J.W. Arbogast, and D.R. Macinga. Bacterial hand contamination and transfer after use of contaminated bulk-soap-refill dispensers. *Appl. Environ. Microbiol.* 77: 2898-2904.

PRESENTATIONS

C. P. **Gerba**. "Noroviruses: The number one cause of foodborne illness," and "Reinventing hygiene for the 21st century." Annual Meeting of the Arizona Environmental Health Association. Phoenix, July 19, 2011.



Charles Gerba's "Reinventing Hygiene in the 21st Century" will be airing Sept. 29, Oct. 13 and Oct. 27 on the Florida Education Channel's Panhandle Area Education Consortium. The hour-long presentation is designed for high school students.

C. P. **Gerba**. "Reinventing hygiene in the 21st century" Maricopa County Environmental Health Services. Phoenix, AZ. July 21. Also at AZEHA Spring Conference. Tucson, June 30.

C. P. **Gerba**. "Hygiene in the 21st Century." Annual Meeting of the Minnesota Dental Association. St. Paul, Minn. April 29, 2011.

C. P. **Gerba**. "Environmental monitoring for foodborne pathogens." Annual Meeting of the International Association for Food Protection. August. Milwaukee, Wisc., Aug. 1, 2011.

G. Curlango-Rivera, A.M. Cochran, S.A. Trinh, J.O. Kessler, Z. Xiong, M.C.

Hawes. Extracellular plant defense responses: Bacterial trapping in real time. American Society for Microbiology, 50th Anniversary meeting, April 16.

G.Curlango-Rivera, Z. Xiong, J.O. Kessler, M.C. **Hawes**. Extracellular trapping of bacteria in plant defense responses: Dynamics and specificity. American Phytopathological Society, July 2011.

Kulkarni, R., M. **Tuller**, W. Fink, and D. Wildenschild, 2011. Three-dimensional multiphase segmentation of X-Ray CT data of porous materials using a Bayesian Markov Random Field framework. Workshop on Image Analysis for Porous Media, Austin, Texas, July 14-15, 2011.

Lim B., S. O'Connor, G. Curlango-Rivera, M.C. **Hawes**. Extracellular DNA vs. extracellular DNase: Trapping and release at the interface of root-microbe interactions. Undergraduate Biology Research Program Conference. Jan. 11, 2011.

M. C. **Hawes**, G. Curlango-Rivera, Z. Xiong. Extracellular DNA: an overlooked component of eucaryotic defense.

American Society for Plant Biology. August 2011.

Pepper, I. The future of residuals and biosolids management. 84th Annual Arizona Water Conference. Glendale, Arizona. May 4-6, 2011.

Pepper, I. Pathogens and indicators in U.S. Class B Biosolids, national and historic distributions. 84th Annual AZ Water Conference. Glendale, Arizona. May 4-6, 2011.

Pepper, I. Fate of chemical and biological emerging contaminants in biosolids and after land application. Residuals and Biosolids 2011, Sacramento, Calif., May 22-25.

Pepper, I., H. Zerzghi, S. Bengson, B. Iker, and J. Brooks. Copper mine tailings amended with Class A Biosolid: Long-term effects on soil bacterial populations. 4th Congress of European Microbiologists, FEMS 2011, Geneva Switzerland, June 26-30, 2011.

Pepper I., D. Quanrud, H. Zerzghi, C. Leung, and C. **Gerba**. Fate of endocrine disruptors following long-term land application of Class B Biosolids and risks to public health. 3rd International Conference, EmCon 2011, Copenhagen, Denmark, August 23-26.

Rensing, C. Surprising twists in regulation of copper and arsenic metabolism. Oregon Health and Science University, Portland. Feb, 11, 2011.

Rensing, C. Pumping iron and copper handling for a healthy future. J. Craig Venter Institute, San Diego, Calif., March 16, 2011.

R. Root, F. Alday, S. Fathordoobadi, W. Ela, and **J. Chorover**. Synchrotron XAS and XRF study of microbially reduced arsenic and iron in iron-based remediation media. Goldschmidt conference, "Earth, Life and Fire." Prague, Czech Republic. August 14-19, 2011.

Tuller, M., 2011. Application of X-Ray micro-computed tomography in the earth and environmental sciences. Invited Keynote Lecture for Bouyoucos Conference on Synchrotron Analyses of Airborne Soil Particulates Originating from Agricultural and Modified Ecosystems. Estes Park, Colo., Aug. 1-2, 2011.

Tuller, M., 2011. A new generation of high-resolution benchtop micro-CT scanners for application in earth sciences: Comparison to synchrotron micro-CT. Invited lecture for the Department of Earth Sciences, Boston University, May 5, 2011.

DEPARTMENT NEWS

SWES plays role in Statewide Design Competition

Mathematics, Engineering, Science Achievement (MESA) holds an annual Statewide Design Competition for middle school and high school students across Arizona. During the 20th annual event in April of 2011, students were charged for the first time with developing a working rainwater harvesting model.

Professor **James Riley** and seven UA students from his *Water Harvesting* course (SWES 454) served as judges for the contest: **Isaiah Frangouli, Sara Leischow, Sheena Lucas, Rachel Maxwell, Nigel Shemanski, Tae Tak, and Shane Clark.**

All the water harvesting judges participated in a two-hour dinner/training session on April 29 and spent seven hours on April 30 evaluating and judging entries submitted by students from 25 schools across the state.

Dr. Riley had also helped teachers from the middle and high schools prepare for the new competition by briefing them on water harvesting principles in October of 2010 during a session held at Biosphere 2. MESA representatives Manny Leon and Reed Dickson also attended several sessions of the *Water Harvesting* class and participated in some of the “hands-on” exercises with the UA students in order to familiarize themselves about water harvesting concepts and techniques.

All competitors, judges, and MESA representatives wore “Knowledge is Power” T-shirts with the SWES logo prominently displayed among other sponsors. SWES was included in recognition of the time commitment from Dr. Riley and his class to the Water Harvesting Design Competition.

SWES research featured on *Southwest Environment*



Photo by Ruth Hook

Research by SWES faculty members **Ian Pepper, Charles Gerba** and **Channah Rock** were featured in stories by students posted on the department’s *Southwest Environment* website. Students interviewed a variety of experts from within and outside the department as part

of the *Translating Environmental Science* course (SWES 415/515) taught by **Melanie Lenart**. The best of the stories were published on the website. SWES webmaster **Karen Josephson** led the design of the website and posting of student stories. Read the stories or download them for use elsewhere at: http://ag.arizona.edu/swes/environmental_writing/stories.html

SWES student shares water harvesting knowledge

Eric Nyerges, a major in Environmental Science, gave a presentation on the importance of water harvesting to more than 100 students from Tucson’s Gridley Middle School during a May 16 UA symposium. The symposium, organized by Kerry Schwartz of Arizona Project WET and the Water Resources Research Center, gave Gridley students a chance to see water features at the UA and to present the results of their own water audit and conservation studies at their school.

Nyerges was enrolled in James Riley’s *Water Harvesting* class in the spring 2011 semester. The UA students developed a handbook for use by teachers at Gridley to help them incorporate water harvesting into their science and sustainability curriculum.

SWES students learn conservation biology in Namibia

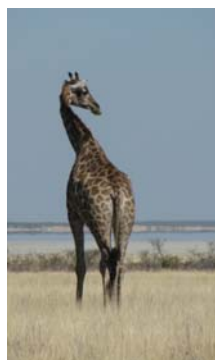


Photo by Tom Wilson

SWES Instructor **Thomas Wilson** once again helped teach *Desert Ecology and Conservation Biology in Namibia* (SWES 495A/595F). The six-week course exposes students to a multitude of experiences as they travel throughout this semi-arid country in southwestern Africa. Four SWES undergraduates took the course during the summer of 2011: **Daniel Basubas, Noelle Espinosa, Bradley Schmitz** and **Kristina Solheim**. For more information on the course, go to the link below:

<http://ag.arizona.edu/swes/classes/namibia/index.html>.

SWES students participate in RCRA seminar

Four Environmental Science undergraduate students – **Molly Van Dop, Owen Maurer, Noelle Espinosa, and Wang Ruan** – attended a day-long seminar on the latest local information on the management of hazardous materials covered under the Resource Conservation and Recovery Act (RCRA). The Southern Arizona Environmental Management Society (SAEMS) sponsored their participation in the May 12 seminar held at Manning House.

Allan Matthias and James Riley shared information on SWES academic programs at a table sponsored by the department. They were pleasantly surprised to meet former SWES students who are now members of SAEMS, including David Mack and Fred Nacaroti (Ninyo & Moore), Nicole Urban-Lopez (formerly with Tucson’s Office of Conservation and Sustainable Development, now with Raytheon) and Sarah Hartwell (Terracon).

SWES appreciates the assistance of Frank Bonillas of SAEMS and of the RCRA Seminar Committee in sponsoring students.

Maier’s research efforts featured in news reports

On July 7, KVOA news reporter Tom McNamara described how work by **Raina Maier** and other UA researchers were helping to stabilize arsenic in tailings piles at the Iron King Mine Superfund site near Prescott. The report featured an interview with Dr. Maier, and highlighted how the researchers were using compost so that plants could grow on the tailings site, and therefore reduce the risk that arsenic would contaminate the air or water. To view the story, go to <http://www.kvoa.com/videos/investigators-toxic-water/>

On June 26, Arizona Public Media reporter Gisela Telis prepared a web-based story featuring work by Maier and some of her graduate students, including **Marianyoly Ortiz** and former graduate student **Luisa Ikner**. The ongoing research involves identifying microbes as part of the Kartchner Caverns Microbial Observatory project. Maier and other UA researchers and students have carried out a variety of research efforts in the five years that the project has been supported by the National Science Foundation.

To read the story, go to:

<http://www.azpm.org/science/story/2011/6/26/00-web-feature-what-lies-beneath/>