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Myakka

Research Innovation in Soil, Water and Environmental Sciences

contents

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Research Innovation in Soil, Water, and Environmental Sciences

From the Chair...

The Soil and Water Science Department (SWSD) developed a Research Roadmap to address critical soil, water, and environmental issues related to sustainable production (food, fiber, and fuel), water quality, water conservation, soil quality, carbon sequestration, greenhouse gas emissions, and public health. The plan was developed with input from state-wide faculty and students, and will be presented to our clientele groups for further discussion and input. The road map functions as a guide to accomplish the Department's future goals and includes goals and strategies aimed to achieve preeminence. A successful plan requires faculty creativity, innovation, and flexibility to capture unexpected opportunities and to address future challenges. The plan is adaptive in nature, and will continuously change to ensure that the department's vision, core values, and goals remain relevant to meet the changing needs of our clientele.

The faculty in SWSD are actively involved in addressing various emerging issues including: (1) developing best management practices to protect water quality and maintain sustainable crop productivity; (2) remediating contaminated soils, aquifers and waters; (3) addressing urban issues including water-borne pathogens and emerging contaminants; (4) evaluating the capacity of stormwater treatment systems to retain contaminants; (5) determining carbon sequestration under various land-use activities, and (6) protecting and restoring natural systems such as wetlands, lakes, and other aquatic systems. The statewide network of SWSD faculty are currently involved in several aspects of soil, water, and environmental issues and are working closely with other disciplines and state agencies, through teaching, research, and extension programs.

To address these complex inter-related issues, the SWSD research programs are developed in an interdisciplinary format by maintaining disciplinary strength. The SWSD faculty actively collaborate with researchers in other UF departments and other universities and state and federal agencies, by offering complementary programs. In this newsletter we present a few examples of research innovation by the SWSD faculty.

K R Reddy

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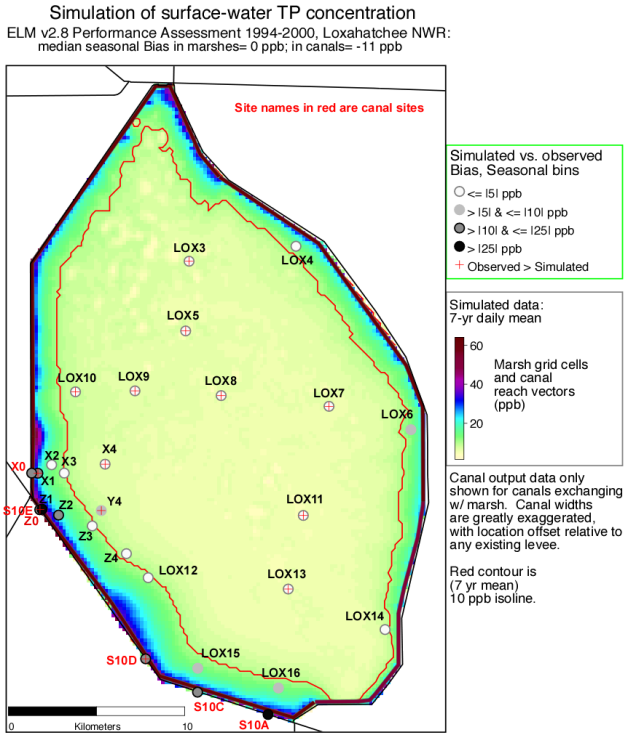
A New Approach to Predicting Safe Phosphorus Loading in Soils

Graduate student Jeremy Paris extracts a soil sample from an isolated wetland in Conecuh National Forest near Andalusia, Alabama (image by Eric Jorczak).

Researchers at the Soil and Water Science Department have developed a new approach, the "Safe" Soil P Storage Capacity (SPSC) based on a threshold phosphorus (P) saturation ratio (PSR) that was developed recently for Florida soils. This concept has applicability in sandy soils of the US as well as in other parts of the world. The SPSC provides a quantitative measure of the amount of P a soil can receive before that soil becomes an environmental risk. Calculations of SPSC can be made using easily obtainable values of P, iron and aluminum from either Mehlich 1 or Mehlich 3 solutions that are the commonly used soil tests for P. The concept, originally developed for surface soils has been expanded to included subsurface horizon soils. Currently we are evaluating the use of PSR and SPSC for wetland soils. The SPSC concept has recently been introduced as a parameter in the Florida P-Index to evaluate P transport potential from a site. For additional information, contact Vimala Nair at: vdn@ufl.edu.

Modeling of Ecological Processes in the Everglades

The landscape ecology program at the Ft. Lauderdale REC is integrating hydrologic, biogeochemical, and biological processes within ecological models of a variety of systems. Put into a spatially explicit simulation framework for analysis of large landscapes, we developed a couple of new model applications for evaluating Everglades ecology over decadal time scales. One involves the A.R.M. Loxahatchee National Wildlife Refuge in the northern Everglades, where there exists a detrimental north-south hydrologic gradient, in addition to eutrophication problems along its boundaries. Working with South Florida Water Management District scientists, we simulated a variety of ecological restoration scenarios, evaluating the tradeoffs between hydrologic benefits and water quality constraints. Ultimately, our recommended restoration plan significantly improved the hydrologic gradient, increased water flows, and had very minimal water quality concerns. For a separate collaboration with the U.S. Geological Survey, we developed a fine-scale model of the regional, greater Everglades system. The outputs from this model will be used to "drive" other ecological models, and to synthesize our understanding of the interactions among soil, plant, nutrient, and hydrological processes across different ecosystems of the Everglades. For additional information, contact Carl Fitz at: cfitz@ufl.edu.



Nutrient Management in Florida's Ranchlands

Beef cattle ranchers can significantly contribute to maintaining and restoring Florida's unique ecosystems. However, because of the extensive acreage occupied by beef cattle in Florida, pasture fertilization can play a major role in non-point source pollution. Nevertheless, sustainability of productive forage systems depends, to a major extent, on pasture fertilization. The fate of fertilizers applied to grassland systems is extremely complex and is affected by several factors including application rate, timing, fertilizer source and soil and environmental characteristics. The factors that affect nutrient use efficiency take on greater importance in Florida, where unique hydraulic conditions and soil characteristics can favor nutrient losses. Our research showed that when properly managed, bahiagrass fertilization may not constitute an environmental concern. Tissue testing used in combination with soil analysis represents a valuable tool to effectively predict P needs in bahiagrass pastures. Our data also indicated that fluctuations in water table levels can play a major role in bahiagrass P nutrition. For additional information, contact Maria Silviera at: mlas@ufl.edu.

Solid Oxygen Fertilizer

Lack of soil oxygen, or hypoxia, is an environmental challenge that can negatively impact seed germination and plant growth. Hypoxia commonly occurs when soil becomes flooded, often leading to acute oxygen deprivation of plant roots by saturating pores in the soil. Currently, there is no product available that can be used to reduce the negative effects of hypoxia due to waterlogged soil. However, our research group discovered that solid oxygen fertilizers provide a means to infuse the soil with an oxygen source that promotes plant survival and growth. Furthermore, this technology can be used to apply an oxygen-releasing fertilizer as a seed coating, providing a controlled release of oxygen as the seed germinates and develops. The solid oxygen fertilizer also improves tolerance of plants to salinity and may enhance resistance of plants to soil-borne diseases. For additional information, contact Yuncong Li at: yunli@ufl.edu.

Welcome... Incoming Students Spring 2009

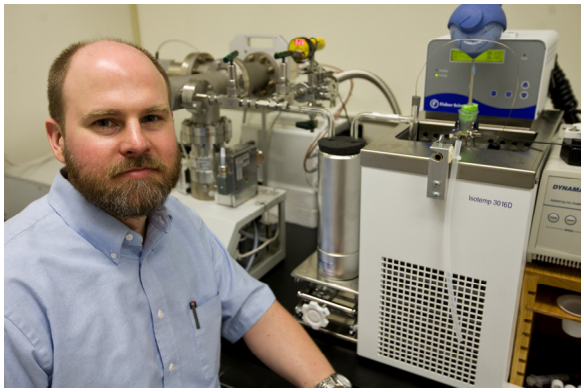
Mica Franklin, PhD (John Cisar)
Wade Ross, MS (Sabine Grunwald)
Ruben Koch, MS (Chris Wilson)
Raymond Powe, MS (Gurpal Toor)

Matthew Jablonski, MS (Gurpal Toor)
John Derek Sain, MS (John Thomas)
Michael Atkin, MS (Samira Daroub)
Timothy Hull, MS (Todd Osborne)

Irrigation and Nitrogen Management for Sustainable Potato Production

Potato is a high economical crop in northeast Florida due to the seasonal advantages compared to other parts of the US. Application of nitrogen fertilizers on sandy soils and the conventional seepage irrigation can simultaneously have deleterious effects on both quantity and quality of water in the lower St. Johns River Basin. Studies were conducted in the Nutrient Management program to determine the water and N- use efficiencies from 2005-2008 under potato production systems. Nearly 87% of the water received was lost during the potato season, rendering the seepage irrigation highly inefficient. An alternate 12 h/day seepage irrigation method was designed and implemented which showed savings of approximately 50% of irrigation water while sustaining optimum potato yields in two out of the three study years. The study further demonstrated that reduced seepage irrigation potentially minimized nitrate leaching and conclusively proved that use of "Controlled Release Fertilizers" for potato production could potentially reduce nitrate leaching compared to soluble urea as N- source. These findings are being considered for potential BMP development and adoption by the agricultural producers in the Tri-County Agricultural Area to help reduce nitrate loading into the lower St. Johns Rivers Basin. For additional information, contact Rao Mylavarapu at: raom@ufl.edu.

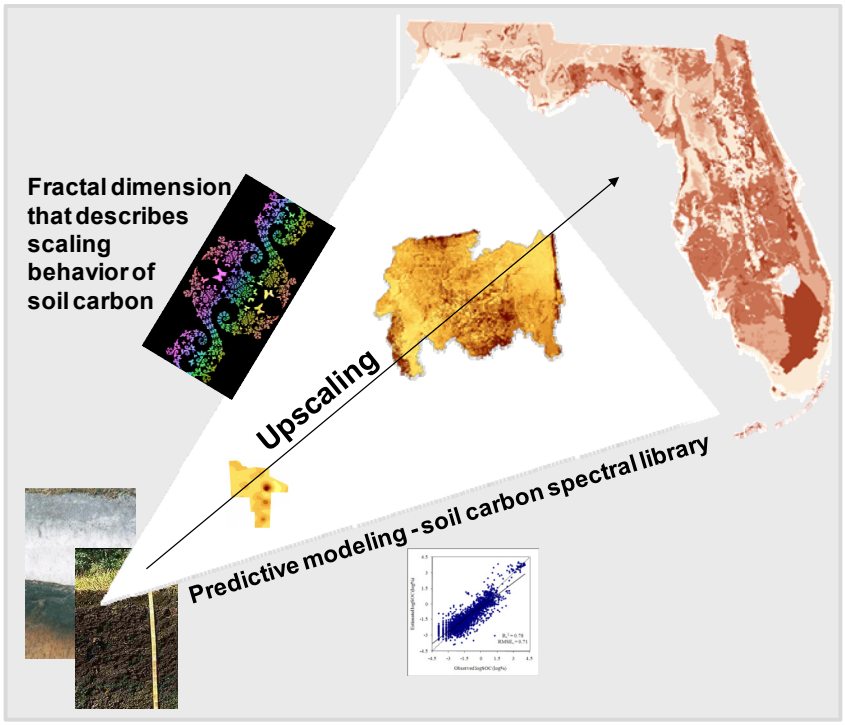
Measurement of Denitrification using Membrane Inlet Mass Spectrometer (MIMS)



Patrick Inglett recently completed the setup and testing of a new Membrane Inlet Mass Spectrometer (MIMS) system in the Aquatic Biogeochemistry Laboratory. The MIMS system is used to measure dissolved gases such as N_2, Ar, and O_2 directly from water samples without degassing steps required in previous methods (e.g., gas chromatography, traditional mass spectrometry). The MIMS system is particularly useful for measurement of denitrification (microbial production of N_2 from reactive N) using recent techniques such as the isotope pairing method which traces added $^{15}NO_3^-$ into the production N_2 with specific masses of 28, 29, and 30, and the N_2:Ar approach to determining net N_2 production relative to a conservative background of argon gas. Both approaches overcome many of the difficulties and errors of traditional incubation or mass balance methods resulting in more precise and accurate, *in situ* measurements of denitrification. Inglett plans to use the MIMS system in his studies of denitrification in various southeastern aquatic systems such as springs, wetlands, and lakes and reservoirs. For additional information contact Patrick Inglett at: pinglett@ufl.edu.

Florida Soil Carbon Mapping

The GIS Laboratory team are involved in carbon science research across the State of Florida. Several approaches are used to assess the spatial distribution of soil carbon stocks and pools and associated ecosystem processes. These include: (1) A ***soil carbon spectral library*** (based on visible/near-infrared spectroscopy) has been built for the State of Florida that allows rapid and cost-effective predictions of soil carbon. The spectral library facilitates (i) accurate soil carbon assessment in various ecosystem types including agroecosystems, forest, urban, and wetlands; (ii) cost-effective assessment of soil carbon to receive monetary rewards through carbon trading; and (iii) assessment of ecosystem services. (2) The project ***'Rapid Assessment and Modeling of Soil Carbon Pools across Florida'*** is a Core Project (USDA-funded) of the U.S. North American Carbon Program (NACP). The project involves upscaling of site-specific soil carbon and carbon pools (labile and recalcitrant) using advanced geostatistical methods, GIS, and remote sensing. The response of land use shifts and global climate warming on Florida's soil carbon budgets is assessed, which facilitates to develop land use management recommendations to enhance soil carbon sequestration. (3) The ***multi-scaling behavior of soil carbon*** across various expanding and contracting spatial and temporal scales is investigated to analyze if models are scale invariant (i.e., show self-similar/fractal or multi-fractal behavior) and identify the key environmental drivers (natural and anthropogenic) that modulate soil carbon spatial patterns under subtropical conditions. Scaling parameters and/or functions are derived that allow seamless up- and down-scaling of soil carbon patterns. For additional information, contact Sabine Grunwald at: sabgru@ufl.edu.



Join us at...

The 10th Annual Soil and Water Science Research Forum

The 10th Annual Soil and Water Science Research Forum is scheduled for September 11, 2009, in Gainesville, Florida. The forum is designed to bring together representatives from state and federal agencies as well as private industry, faculty, graduate students, and prospective students interested in soil and water science. The forum will provide an opportunity for all those interested in soil and water science to interact with our students, faculty, and administrators on campus. This year theme for the forum is on "Research-Extension/Outreach Linkages" in soil, water, and environmental sciences. This year, **Dr. Clifford S. Snyder**, PhD, CCA, Nitrogen Program Director, International Plant Nutrition Institute, Conway, AR is the featured keynote speaker at the forum.

We look forward to your participation in the forum. If you are planning to attend, please register at http://soils.ifas.ufl.edu/forum/. For additional information, contact Andy Ogram aogram@ufl.edu.

Passive Surface Water Flux Meter

The Environmental Hydrology Laboratory has recently developed a novel (US Patent 7,284,448) device for measuring water and solute fluxes in flowing surface waters. The device has no moving parts and is passive, thus requiring no internal or external power supply. Two recent papers describe the passive surface water flux meter (PSFM) laboratory development (Klammler et al., 2007, Environmental Science & Technology) and initial field testing (Padowski et al., 2009, Journal of Hydrologic Engineering). We have used the PSFM to successfully measure nitrate and phosphate fluxes in laboratory flumes, and Sweetwater Branch, Gainesville (attached picture). The PSFM has immense potential for environmental monitoring in applications such as TMDLs and BMP assessments. We now seek partners for further field testing and development. For additional information, contact Jim Jawitz at: jawitz@ufl.edu.

Nutrient Management in Vegetable and Sugarcane Copping Systems

Researchers at Southwest Florida REC, Immokalee have studied the impact of N and P use efficiency, movement and transformation at a field scale on vegetable and sugarcane production in south Florida. Transformation and movement of NH_4-N, NO_3-N and P within plastic mulch covered beds with seepage irrigation has been documented and N and P losses estimated for given environmental conditions. Field level experiments on P use by vegetables have demonstrated significantly increased green bean growth and yield and increased tomato size in soils with high or very high soil P indexes. These soils have elevated soil pH and Ca levels, sequential soil analysis indicates that P is quickly precipitated and thus unavailable to crop plants. This work will lead to improved soil test P indexes for these soils. Improvement in nutrient use efficiency of sugarcane with controlled release fertilizers has been documented at the field level with savings of 25% or more of applied N with no significant reduction in yield. For additional information contact Kelly Morgan at: ktm@ifas.ufl.edu.

Grower Vegetable Field Day at SWFREC

Faculty, Staff, and Students

Congratulations to the faculty, students, and staff for their outstanding achievements in soil and water science.

Jim Jawitz has been recognized with the College of Agricultural and Life Sciences (CALS) Graduate Teaching/Advising Award for 2008.

Congratulations to **Andy Ogram** and **Zhenli He** for their selection as UF Research Foundation Professors for the period of 2009-2012. Andy and Zhenli join nine other SWS faculty who were selected for this award during previous years.

Max Teplitski co-edited (with Dr. Anita Wright) a special Food Safety Issue of Current Opinions in Biotechnology. The theme of the Special Issue is "Thinking Beyond the HACCP". It focuses on questions of safety of foods such as a produce, artisan cheeses and shellfish.

Hugh Popenoe received the first Charles B. Heiser, Jr. Mentor Award. Hugh was selected for this award by the Student Committee of the Society of Economic Botany. This award was initiated to honor outstanding economic botanists who have substantially impacted the training and professional development of economic botany and ethnobotany students. This award, chosen by students, spotlights dedicated educators who foster the development of the field by example and through student mentoring.

Sabine Grunwald (UF) and **V. Balaji (ICRISAT)** organized an outstanding workshop during May 10-15, 2009 at ICRISAT, Hyderabad, India on "Integrated Education, Research and Extension - eTools & Reusable Learning Objects (RLOs)". The workshop was part of an US-India Agricultural Knowledge Initiative project. The workshop was attended by 25 participants including several high level officials from various Indian Universities. Other US participants in the workshop included Dr. Mortimer Neufville (Association of Public Land-grant Universities); Brandon Hoover, Craig Stanley, and Ramesh Reddy.

Student design team under the advisement of **Jim Jawitz** won 1st prize for the student poster competition at the American Water Resources Association Annual Water Resources Conference, New Orleans, LA, November 17-20, 2008. Team was part of USEPA P3 (People, Prosperity, Planet) competition and included **Jehangir Bhadha** (SWS), David Kaplan (ABE), Aaron Bunch (FAS), and Gordon Brown (EES). PhD student **Jehangir Bhadha** selected for 2008 College of Agriculture and Life Sciences Doris Lowe and Earl and Verna Lowe Scholarship ($1500)

Debolina Chakraborty (Advisor, Vimala Nair) received a third place at the 2009 Environmental Engineering Sciences Symposium, Graduate Student Poster Competition hosted by the UF Air and Water Management Association and the Society of Environmental Engineers.

Matt Miller (Advisor, George O'Connor) was selected for the 2008 Excellence in Graduate Studies-MS Award in Soil and Water Science

Matt C. Vann graduated in the spring semester commencement with Bachelor of Science, *cum laude*, in interdisciplinary studies in environmental management in agriculture and natural resources. Matt was the commencement speaker at the CALS Spring 2009 commencement event.

Soil and Water Science undergraduates **Drew McLean** and **Katlyn Woodruff** and Environmental Management undergraduates **Debra Flinn**, **Melissa Jabat**, and **Matthew Vann** received Dean's List recognition for their academic performance in Spring 2009. CALS Dean's List criteria are 3.70 GPA with a minimum of 12 semester hours of graded credits.

Congratulations!

Spring 2009 Graduates

PhD

Kimberly Epps (Comerford)
Kirandeep Mann (Schumann/Obreza)
Melissa Martin (Reddy)

Master of Science

Cort Catts (Reddy)
Anhui Huang (Ma)
Daniel Moura (Silveira/O'Connor)
Shannon Smith (Jawitz)
Jessica Taft (Wright)
Laura Waldo (Schumann)

Bachelor of Science

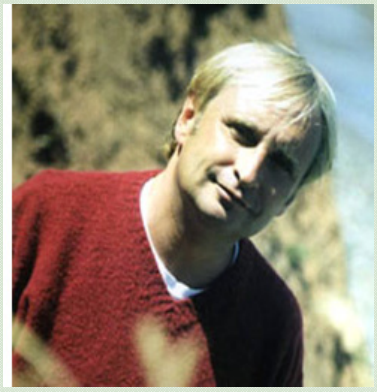
Melissa Jabat
Drew McLean
Patrick Moran
Matthew Vann

Myakka

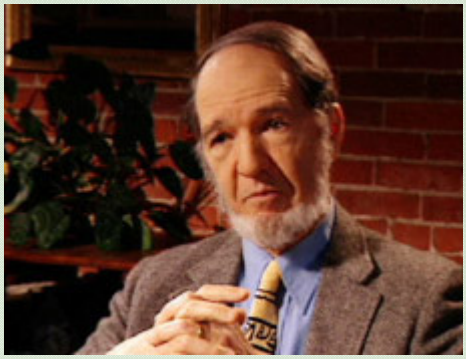
(pronounced 'my-yak-ah' - Seminole word for "big waters") gives a special identity to our department, as it is also the name of Florida's State Soil, Myakka fine sand. The State of Florida has the largest total acreage of Myakka fine sand (sandy, siliceous, hyperthermic Aeric Alaquod) on flatwood landscapes.

Invited Distinguished Speakers ……..

Dr. Barbara Sherwood Lollar, Professor in Geology at the University of Toronto, and Director of the Stable Isotope Laboratory, presented 2009 David Hubbell seminar on February 6, 2009. Topic of her seminar was "Tracing contaminant source and fate in groundwater using carbon specific isotope analysis". She has published extensively on geochemistry and environmental science and holds numerous research awards for her work with international scientists and industrial collaborators. She was the 1998 Henry Darcy Distinguished Lecturer for the United States National Ground Water Association, an NSERC E.W.R Steacie Fellow (1999-2001) and currently holds a Canada Council Killam Research Fellowship (2004-2006). In 2000 she was profiled as one of TIME Magazine's "Leaders for the 21st Century" based on her research on innovative techniques for tracking organic contaminants in groundwater. Additional information about Dr. Lollar can be found at http://www.chem.utoronto.ca/peoples/faculty_profile.php?id=60



Dr. Alex B. McBratney, Pro-Dean Faculty of Agriculture, Food and Natural Resources; Professor of Soil Science; Director of the Australian Centre for Precision Agriculture; University of Sydney, Australia was visiting with faculty, students and staff in the Soil and Water Science Department (May 20 -22, 2009). Dr. McBratney presented the Soil and Water Science Distinguished Seminar on digital soil mapping techniques transitioning into advanced monitoring schemes to accurately access spatial and temporal patterns of soil resources in Australia and around the globe. GIS, remote and soil sensing along with quantitative modeling across multiple scales (field to landscape scale) offer exciting opportunities for soil science research in the future. Dr. McBratney is an internationally known leading scientist in digital soil mapping / pedometrics ("quantitative soil science"). He received his PhD in soil science from the University in Aberdeen, Scotland. His research interests include quantitative modeling of spatial and temporal patterns of soil properties and processes and how they relate to environmental factors using geostatistical and statistical methods and mechanistic approaches. Additional information about Alex McBratney can be found at: http://www.usyd.edu.au/su/agric/acpa/people/alex/AlexMcB.htm http://www.usyd.edu.au/su/agric/acpa/; http://www.agric.usyd.edu.au/



On April 9, 2009, SWSD co-sponsored a visit by **Dr. Jared Diamond** with the UF Office of Sustainability. Dr. Diamond, Professor of Geography at UCLA, presented a lecture on his most recent book, Collapse: How Societies Choose to Fail or Succeed to a full house at the Phillip's Center for the Performing Arts. In Collapse, the Pulitzer-Prize winning author builds a strong case for environmental stewardship, particularly with respect to the soil. Collapse is used as a textbook in SOS 2008 Land and Life.

http://www.spotlight.ucla.edu/impact/more-impact/april-2008/