8th Annual Soil & Water Science

RESEARCH FORUM

Program & Abstracts

September 14, 2007
J. W. Reitz Union, Room 282

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SOIL & WATER SCIENCE

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INTRODUCTION

Welcome to the 8th Annual Soil and Water Science Research Forum sponsored by the Soil and Water Science Department (SWSD), IFAS, University of 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 provides an opportunity for all those interested in soil and water science to interact with our students, faculty, and administrators on campus.

The SWSD faculty are located both on the main campus in Gainesville and at several off-campus Research and Education Centers. The mission of the department is to conduct basic and applied research on soil- and water-related problems associated with sustaining agriculture and protecting natural resources. Thus, our faculty and students conduct research and education in a wide range of ecosystems including: agricultural lands, urban lands, rangelands, forested lands, and wetlands and aquatic ecosystems, with emphasis on productivity and water quality. Research efforts are organized into the following general areas:

- Management of nutrients, pesticides, and wastes
- Remediation of contaminated soils, waters, and aquifers
- Soil quality and ecological indicators
- Soil and landscape analysis
- Wetlands and aquatic systems

Research conducted by graduate students and post-doctoral fellows is the core of the SWSD research programs. At present 124 graduate students (including 63 in the distance education program) and 19 post-doctoral associates support current research activities in the department. For this year's Forum we offer you select examples of the research conducted by these young scientists. Presentations include 5 oral papers and 50 poster papers. For those of you interested in our programs, please contact me or any one of our faculty members.

Thanks to the Faculty Research Forum Committee, Lena Ma (Chair), Mark Clark, Jim Jawitz, Sabine Grunwald, Rao Mylavarapu, and Andy Ogram, for their effort in organizing the Forum. Special thanks to Jehangir Bhadha (graduate student), Alex Cheesman (graduate student), and Rhiannon Pollard (Program Assistant) for their hard work in making final arrangements for the Forum. Finally, I want to express my appreciation to all students, post-doctoral fellows, staff, and faculty for their active participation in the Forum. We thank our collaborators from various state agencies and the industry for their support of our programs.

Sincerely,

K. R. Reddy
Graduate Research Professor and Chair
krr@ufl.edu

KEYNOTE SPEAKER

Kenneth Nealson

Wrigley Chair in Environmental Studies
Professor of Earth Sciences and Biological Sciences
University of Southern California

Dr. Kenneth Nealson is Wrigley Professor of Geomicrobiology at the University of Southern California, and has held faculty positions at the Jet Propulsion Lab, Cal Tech, the University of Wisconsin-Milwaukee, and Scripps Institute of Oceanography, UCSD. Professor Nealson pioneered the field of modern geobiology – an area of science that tackles the still largely unexplored domain where the processes and chemistry of life intersect with the planet's mineral and metal chemistry. In his early work as a marine microbiologist, Nealson discovered quorum sensing, a phenomenon in which bacterial cells communicate with other members of the community. As one of the first to recognize the importance of microorganisms in catalyzing redox reactions in the environment, he has led the development of tools to study these organisms. Nealson's techniques, used to study microbial populations through genetic identification, are now considered standard in analyzing microbes found in biofilms. On a much larger scale, Nealson has studied the cycling of such minerals as iron and manganese, revealing the key role of microorganisms in these biogeochemical processes. More recently, he has turned to figuring out how life can function in extreme environments, and he is directing efforts at NASA to search for life and evidence of ancient life in the solar system.

Presentation Title: ***Cleaning Up Waste, Generating Clean Water, and Getting Paid For it!***

INVITED SPEAKERS & PANEL MEMBERS

Mary C. Hartney
President/Executive Director
Florida Fertilizer and Agrochemical Association

Rich Budell
Director
Office of Water Policy
Florida Department of Agriculture and Consumer Services

Ed Lowe
Director
Environmental Sciences Division
St. Johns River Water Management District

Dean Powell
Director
Watershed Management Department
South Florida Water Management District

Ronnie Best
Coordinator
Greater Everglades Priority Ecosystems Science
United States Geological Survey

PROGRAM

Friday, September 14th, 2007
Room 282, J.W. Reitz Union

8:15 - 8:45 Registration & Refreshments

8:45 - 9:00 Opening Remarks
K.R. Reddy, SWSD Chair

9:00 - 9:45 ***Cleaning Up Waste, Generating Clean Water, and Getting Paid For it!***
Kenneth Nealson, Wrigley Chair in Environmental Studies and Professor of Earth Sciences and Biological Sciences, University of Southern California

10:00 - 12 NOON **Invited Speakers Present:** ***Research Issues and Opportunities***
Mary Hartney, Florida Fertilizer and Agrichemical Association
Rich Budell, Florida Department of Agriculture and Consumer Services
Ed Lowe, St. Johns River Water Management District
Dean Powell, South Florida Water Management District
Ronnie Best, United States Geological Survey

12 NOON - 1:30 Lunch on your own

ORAL PRESENTATION SESSION

Presiding: Jehangir Bhadha

1:30 - 1:45 ***Nutrient-Use Efficiency and Long Term Storage of Nitrogen in Restored Wetlands in the Everglades National Park***
Angelique Keppler, Ph.D. Student, Univeristy of Florida, Advisor: K. R. Reddy

PROGRAM, *continued*

1:45 - 2:00 ***Determining Indicator Soil Properties Affecting Spatial Patterns of Yield Reduction in a Florida Citrus Grove***
Kirandeep Mann, Ph.D. Student, University of Florida, Advisor: A. Schumann

2:00 - 2:15 ***Post-fire Ash Nutrient Form and Availability of Cattail and Sawgrass Growing along a Nutrient Gradient in Florida Everglades***
Yun Qian, Post-Doctoral Associate, University of Florida

2:15 - 2:30 ***Geospatial Modeling of Dynamic Soil Carbon Pools at the Watershed Scale***
Gustavo Vasques, Ph.D. Student, University of Florida, Advisor: S. Grunwald

2:30 - 2:45 ***Green Roofs: An Urban Stormwater BMP for Water Quantity and Quality in the Subtropics***
Sylvia Lang, Ph.D. Student, University of Florida, Advisor: M. Clark

2:45 - 3:00 ***Determination of Soil Sorption Coefficient (KOC) of Strongly Hydrophobic Organic Chemicals (SHOCs) Using Mixed Solvents and the Solvophobic Model: Probe Pesticide, Dieldrin***
A. Muwamba, Advisor: P. Nkedi-Kizza

POSTER VIEWING & RECEPTION

East & West Galleries of the J.W. Reitz Union

3:00 - 4:00 Session I
Odd-Numbered Posters - Authors Present

4:00 - 5:00 Session II
Even-Numbered Posters - Authors Present

6:00 PM ADJOURN

ABSTRACTS

Oral Presentations

Room 282, J.W. Reitz Union

Nutrient-Use Efficiency and Long Term Storage of Nitrogen in Restored Wetlands in the Everglades National Park

A. Keppler
Advisor: K. R. Reddy

The Hole-in-the-Donut (HID) region of the Everglades National Park (ENP) offers a unique opportunity to investigate the successional development of vegetation and the impact of macrophyte diversity on ecosystem functions, including biomass production, nutrient availability and storages. Beginning in 1989, the ENP employed a "scraping" method to remove and control a non-native pest plant Schinus terebinthifolius which invaded the area due to disturbance from farming. This method involves the mechanical removal of existing Schinus and underlying rock-plowed rubble and substrate leaving behind bedrock with pockets of captured substrate material. To investigate site differences in vegetation community structure and use efficiency of nitrogen (NUE), a year long 15N stable isotope study was conducted. In addition to investigating NUE of the vegetation, long term storages of nitrogen was evaluated in the soil, litter layer, microbial biomass communities and inorganic nitrogen pools (NH4 and NO3). Soil and litter samples were collected at 24 hrs after application and 6, 12, 24, and 52 weeks and analyzed for TC, TN, TP, MBC, MBN, NO3 and NH4. Live, standing dead, root, and litter vegetation samples were collected at 24 and 52 weeks; and vegetation biomass was determined at 52 weeks. All samples collected were analyzed for 15N enrichment to determine long term storage and competition for nitrogen. Initial analysis of the 15N data indicate that the vegetation present in the reference sites incorporate approximately 4 times more nitrogen than the vegetation present in the site restored in 2003 indicating that nitrogen is less available after restoration.

Determining Indicator Soil Properties Affecting Spatial Patterns of Yield Reduction in a Florida Citrus Grove

K. Mann
Advisor: A. Schumann

Spatial yield reduction and soil heterogeneity were studied in a Florida citrus grove (10 ha) located near Wauchula in Hardee County, Florida to identify soil properties responsible for differentiating soil productivity. Tree canopy volumes were measured and mapped in the grove using an ultrasonic array and DGPS receiver in order to quantify productivity. Fruit yield was mapped from harvester trucks equipped with DGPS receivers and data loggers, and the normalized difference vegetation index (NDVI) was calculated from color-infrared aerial photographs of the grove. The grove was classified into five groups of productivity zones as representative of very good, good, medium, poor and very poor growth areas based on the canopy volume. Soil samples were collected from 30 representative locations at 4 profile depths (0-15, 15-30, 30-45, 45-60 cm) and analyzed for their pH, color, organic matter (OM), Mehlich I- extractable nutrients, cation exchange capacity (CEC) and oxalate extractable Fe and Al. All the soil properties showed a continuous decrease along the productivity gradient and along the depth in all the productivity zones. The regression analysis showed that a significant amount of spatial variation in canopy volume and yield was explained by average soil profile properties including color, OM, CEC, P and oxalate extractable Al. The correlation analysis of soil properties with citrus canopy volume indicated that the canopy volume was highly positively correlated with OM (r=0.71), CEC (r=0.73), P (r=0.85), and oxalate extractable Al (r=0.72) and highly negatively correlated with parameter of lightness of color 'L' (r= - 0.74). The correlation coefficients increased with the depth up to 60 cm. Interpolation by kriging indicated lower organic matter and nutrient status in the areas of St. Lucie fine sand. These parameters had lower values in the center from North to South and higher in the Eastern and Western parts of the grove. The results showed that the effect of soil properties on citrus production was pronounced in deeper layers indicating the need for deeper soil sampling. Easily measured soil properties like the color and organic matter content are good indicators of soil productivity and could guide site-specific management for the poor areas of the grove.

Post-fire Ash Nutrient Form and Availability of Cattail and Sawgrass Growing Along a Nutrient Gradient in Florida Everglades

Y. Qian
Co-Authors: Y. Li, B. Gu, & S. Miao

Post-fire ash plays an important role in nutrient balance and cycling in ecosystems. Factors that determine composition and availability of ash nutrient include fire intensity, plant species, habitat nutrient gradient and leaf type (live or dead leaf). Our objective was to use laboratory simulation methods to evaluate temperature effects on nutrient (carbon (TC), nitrogen (TN), phosphorus (P), and metals) compositions in residual ash of sawgrass (Cladium jamaicense Crantz) and cattail (Typha domingensis), particularly to asses post-fire P availability in plant ash. Live and dead leaf samples were collected from Water Conservation Area 2A (WCA 2A) in the northern Everglades along a soil P gradient, where prescribed fire has been used to accelerate recovery of this unique ecosystem. Significant differences in nutrient compositions were observed in terms of species, sampling plots, and leaf types. Dramatic decreases in TC and TN were detected with increasing fire temperature, and organic matter consumption was nearly complete at temperatures of 450 °C or higher. The P fractionation results of completely burned plant ash in laboratory experiments suggested that HCl-extractable P (average 50%) and NH4Cl-extractable P (average 33%) are by far the predominant P components, followed by residual-P with average of 16%, water-extractable P and NaOH-extractable P are minor fractions (average 0.2 and 0.8%). More labile inorganic P was reserved in sawgrass than in cattail leaves. Compared to laboratory burned cattail ash, field collected ash reserved less labile P, indicating different burning temperature and surrounding environment (air movement, rainfall) between laboratory simulation and field fire. These results will trigger an insightful understanding of fire effects on nutrient species particularly P fractions in plant ash and their eventual impacts on ecosystem.

Geospatial Modeling of Dynamic Soil Carbon Pools at the Watershed Scale

G. Vasques
Advisor: S. Grunwald
Co-Authors: S. Grunwald, J. Sickman, & N. Comerford

There is an increasing demand for cost-effective and accurate methods to create digital maps of soil carbon (C) across large landscapes. Such carbon inventories provide important information on mitigation potential of soil-landscapes to sequester C and to offset increasing concentration of CO2 in the atmosphere. The objective of our study was to create maps of five different soil C pools, based on their interaction with ancillary landscape environmental data. Long-term sequestration of C typically involves movement of C into the stable recalcitrant pool from the smaller labile pool which has greater exchange with the atmosphere. We aim to elucidate on the contribution of different C pools to the total stock of soil C at the watershed scale and to identify to what level these C pools are influenced by collocated environmental properties. We hypothesize that human factors like land use are more influential in the amount of C in the soil than natural factors, such as topography or climate.

We used 141 observation sites in the Santa Fe River watershed (3,585 km2), Florida across soil-land use trajectories. Soil C properties addressed in this study were: total C, hydrolysable C (6 N HCl), recalcitrant C, mineralizable C, and dissolved organic C. We based our soil landscape model in well-known conceptual models of soil formation and used a wide variety of environmental explanatory data that included climatic, pedologic, topographic, geologic, vegetative, and human-influenced factors. We used different multivariate regression methods to model the global spatial trend, and ordinary kriging to account for local random variability.

Our approach provides a comprehensive assessment of how different biogeochemically active C pools interact with the landscape through its environmental attributes in a wide variety of soils. The identification of environmental factors that influence the amount of C in the soil is important to support sustainable land management and guide initiatives to sequester atmospheric C into soils.

Green Roofs: An Urban Stormwater BMP for Water Quantity and Quality in the Subtropics

S. Lang
Advisor: M. Clark

Green roofs act as an urban stormwater Best Management Practice (BMP) by reducing the volume of water leaving rooftops, however little information exists regarding the water quality benefits/impacts of vegetated roofs on stormwater. Additionally, there is a lack of information about the optimal growing media, depth and type and plant type for the sub-tropics. The objectives of this study are to 1) determine the optimal soil depth, soil medium and plant type for extensive green roofs in the subtropics, 2) characterize the runoff retention capabilities of green roofs in the subtropics and mid-Atlantic, and 3) determine whether green roofs act as a sink or source for nutrients and characterize the mechanisms by which this occurs. Objectives are being tested via i) monitoring the Charles R. Perry Yard Green Roof on the UF Campus, ii) a paired green roof/conventional roof study in Virginia, and iii) 39 green roof containers and 12 green roof platforms testing three soil media, three plant types and two soil depths. Hydrology data gathered in Virginia between May 2006-August 2007 indicate that the green roof retained 85% of runoff volume during small storm events (<1" precipitation) and increased the lag time of the peak of the storm hydrograph by 25 minutes for these storms, as well as increased the duration of rerelease of the stormwater by 6-8 hours. No significant differences were found in orthophosphate, nitrate/nitrite or metals between the conventional and green roof. Leachate collected from the container experiment in Florida shows that there are significant differences in TP, TKN and TSS concentrations and loads among the growing media types, but no significant differences between plant types, within the same growing media.

Determination of Soil Sorption Coefficient (KOC) of Strongly Hydrophobic Organic Chemicals (SHOCs) Using Mixed Solvents and the Solvophobic Model: Probe Pesticide, Dieldrin

A. Muwamba
Advisor: P. Nkedi-Kizza

Sorption coefficients (KOC) in soils of strongly hydrophobic organic chemicals (SHOCs) have been reported in the literature to vary widely. For example dieldrin which is one of the persistent organic pollutants (POPs) has KOC values reported to vary from 12,000 to 35,000. A major source of variability in KOC values is sorption of SHOCs on container walls and vessels during the analysis of solute solution concentrations in aqueous systems. Since SHOCs have low aqueous solubility, to reduce sorption on container walls mixed solvent systems (methanol + water) were used to measure sorption isotherms of dieldrin in the range of fraction of methanol where there is no sorption on centrifuge tubes and HPLC vials. Using the Solvophobic model, the sorption coefficients (KM) obtained in mixed solvents were extrapolated at zero fraction of methanol to calculate sorption coefficient (KW) in aqueous systems. The sorption coefficient was then normalized to soil organic carbon content (OC) to obtain (KOC = KW/OC). Five soils and one type of centrifuge tubes (Teflon) were used in this study. The solution concentration of dieldrin was measured by HPLC with UV detection. Dieldrin sorption on container walls in aqueous systems varied from 6% recovery in HPLC glass vials to 31% recovery in Teflon centrifuge tubes. The sorption data on soils, centrifuge tubes, and HPLC vials were used to calculate the hydrocarbonaceous surface area (HSA) of dieldrin. The values of KOC for dieldrin obtained in this study were much less than literature values and did not vary widely across soils, implying that sorption on container walls and vessels might be a major source of error in literature KOC values. Secondly, the values of HSA of dieldrin calculated using centrifuge tubes HPLC vials, and soils were in agreement since in the Solvophobic model the estimation of HSA is a dependent on the properties of methanol-water and dieldrin and not on sorbent properties.

ABSTRACTS

Poster Presentations

East & West Galleries, J.W. Reitz Union

POSTER PRESENTATIONS | JUDGED ENTRIES

POSTER PRESENTATIONS, *continued*

POSTER PRESENTATIONS, *continued*

POSTER PRESENTATIONS | NON-JUDGED ENTRIES

POSTER PRESENTATIONS | NON-JUDGED ENTRIES

(1) A Screen for GacS/GacA Antagonists Reveals Candidate Small Molecules Which May Disrupt Colonization and Virulence in Human Pathogens

C. Cox
Advisor: M. Teplitski

The GacS/GacA system is a two-component sensory system that is evolutionarily conserved in all γ-proteobacterial pathogens, such as Salmonella, Vibrio, Pseudomonas, etc. In S. enterica, GacS/GacA is required for the expression of virulence genes, biofilm formation, motility and surface colonization. While genes controlled by this two-component system have been characterized in many pathogens, little is known about the cue perceived by the sensor kinase GacS. In an attempt to identify a candidate signal, or an antagonist of the cognate signal, a library of pharmaceutically active compounds (LOPAC) was screened. A wild type S. enterica and a constructed gacA mutant with GacS/GacA-controlled csrB-lux reporters were used as a read-out for the screen. The initial screen of over 1200 compounds identified 30 candidates with significant inhibitory activity. Compounds which showed a specific inhibition against the GacS/GacA mediated reporter are being screened against a series of GacS/GacA mutants which are deficient at varying steps of the GacS/GacA pathway to determine the point of the pathway where the compound is active. Because blocking the GacS/GacA system generally has no effect on growth of the bacteria, and is not known to inhibit survival of bacteria in natural environments, chemical inhibitors of the GacS/GacA system may prove to be novel, specific inhibitors of bacterial virulence-related behaviors. For example, blocking the GacS/GacA system is an attractive strategy to eliminate pathogens from live shellfish prior to market. Raw shellfish consumption is an important source of infection and public perception of this risk greatly affects the shellfish industry.

(2) Aluminum Water Treatment Residual Effects on Soil Phosphorus Retention and Forage Quality

J. Driscoll
Advisor: D. Graetz

The movement of phosphorus (P) into freshwater bodies may lead to eutrophication and generally unhealthy biological conditions. Phosphorus loss by surface runoff has been recognized and partially managed by erosion control measures but little has been done to prevent P loss from leaching. Many soils in Florida are characterized by poor P sorbing abilities. In addition, shallow groundwater and extensive ditching result in movement of P via lateral subsurface flow. Water treatment residuals (WTR) are by-products of the drinking water purification process that contain amorphous iron (Fe) and aluminum (Al) with substantial P-fixing capabilities. Many greenhouse studies have shown the ability of WTR to sorb P in controlled environments. In addition to P retention, Al toxicity is an issue when applying Al-WTR. The purpose of this study was to analyze the effects of an Al-WTR on soil P retention and forage quality and yield under field conditions. The study site was an established bahiagrass pasture at the University of Florida Range Research and Education Center in Ona, Fl. Soils on the site are Myakka fine sand (sandy, siliceous, hyperthermic Aeric Alaquod). A split-plot design was used for the plots (3.05m X 6.07m) with application method (surface applied versus soil incorporation) as the main plot and WTR rate (0, 35 or 70 Mg ha-1) as the subplot. WTR was applied in January 2007 and forage harvests were taken the following May and June. WTR application did not affect yield or neutral detergent fiber percentages. There was an increase in the soil P sorption capacity of the A horizon between the control and the plot with 70 Mg ha-1 of WTR.

(3) Sustainable Biodiesel: Methane Production from Crude Glycerol and Washwater

J. Duncan
Advisor: A. Wilkie

Energy, environment, and socioeconomic issues are reaching a critical point and society is again turning to renewable energy sources to end the dependency on fossil fuels and unsustainable practices. Biodiesel production, popular in Europe and less popular in the U.S., has been criticized for large energy and environmental inputs to grow lipids and process them into biodiesel. By-products and potential resources of the process are crude glycerol and washwater. Energy content and some nutrient value in the by-products can be recovered by anaerobic digestion. Methane, produced through anaerobic digestion, can make the energy balance of the biodiesel production process more favorable and decrease the environmental impact of the biofuel. The crude glycerol and washwater have high organic strength and biodegradability, making them excellent feedstocks for biogas production. This study demonstrates methane production from biodiesel by products using anaerobic digestion as an energy recovery process. The synergy between waste bioconversion and biofuel production can close the loop between the biofuel and the land, providing a sustainable biodiesel production process.

(4) A Nutrient Management Plan Support System for Assessing Water and Nutrient Utilization in Florida Sugarcane Production

H. Kwon, S. Grunwald

A Nutrient Management Plan Support System (NUMAPS) has been developed to help Florida citrus growers optimizing yields in an economically effective manner while greatly reducing the environmental impacts associated with excess fertilizer and water applications. The system incorporates computer simulation that utilizes a data modeling environment where the processes related to citrus growth, soil moisture, and nitrogen (N) uptake are represented as database objects in an ontology-based simulation (OntoSim). Computer code (Java) used to run the simulation, is generated automatically from diagrams, equations, and symbols, in order to provide accurate assessments of water and N utilization and potential losses via leaching and/or runoff.

Recent efforts have been made to expand the system from its original form as a water and N balance model on mineral soils for citrus to include phosphorus (P) on organic soils for sugarcane. The processes for soil organic matter decay, which are based on the mathematical framework of the CENTURY model, were included as well as dynamics of inorganic nutrients (N and P). Sugarcane growth and its nutrient uptake were modeled according a modified version of the DSSAT-CANEGRO model. Also, the current water balance model was improved by i) simulating an impermeable layer in the soil profile to model a perched water table and ii) introducing vertical and lateral drainage flux in the saturated zone, so that the model hydrology can simulate water table control systems commonly managed on Florida sugarcane fields where sub-irrigation and open ditch drainage are used.

(5) Inorganic Nitrogen Transformation in Tributaries Impacted and Un-Impacted by Fertilizer, Santa Fe River: Microbial and Biogeochemical Regulators

H. Kim
Advisors: A. Ogram & K. R. Reddy

In the Santa Fe River Watershed (3585 km2), northern Alachua County, an increased nitrate concentration has been observed in spring-, surface-, and ground water. It was reported that unconfined areas with inorganic soils or near to streams have higher soil-nitrate nitrogen concentrations that might accelerate nitrate leaching (Lamsal 2006). However, tributaries and floodplain in regions of the watershed occupied by the Boston Farm and the Santa Fe River Ranch Beef Unit may decrease nitrate concentration through denitrification (Frisbee 2006 not published). Therefore, even if the input of nitrate into river system tends to increase, there can be various routes for removal of N through buffer systems such as found in tributaries and floodplains. A greater understanding of the overall inorganic nitrogen cycling in buffer systems near to watershed and factors is needed.

The overall objective of this research is to obtain a more complete understanding of inorganic nitrogen transformations involving ammonification, nitrification, denitrification, and anammox in the tributaries impacted by nursery and ranch operations within the Santa Fe watershed. This study will examine the biogeochemical and microbial regulators affecting the inorganic nitrogen cycling based on availabilities of electron donors and acceptors that drive the different processes in soils harboring varying organic matter concentrations.

High organic and low organic matter sediments for this research were collected from the fertilizer impacted tributary and the un-impacted tributary during Oct, Dec in 2006, March, May and July in 2007. After sampling, the potential ammonification, nitrification, denitrification and anammox, and concentrations of nitrate, ammonium, TKN, MBN, MBC, TOC were determined.

In high organic matter sediments in the impacted tributary, nitrate was removed by denitrification due to high extractable TOC, and the higher ammonium produced by mineralization or fertilizer might be accumulated in the system because it had high potential ammonification and low nitrification rates. The low organic sediments impacted by fertilizer runoff exhibited high nitrate concentrations; however, this nitrate will likely either accumulate or flow into another system due to low potential denitrification rate. High amounts of ammonium from fertilizer are expected to be oxidized into nitrate because this system exhibited higher potential nitrification rates than of the high organic system. In high organic sediments in the un-impacted tributary, a high rate of mineralization supplied the ammonium into system and this ammonium can be oxidized into nitrate by nitrification. In turn, this nitrate was reduced into nitrogen gas by denitrification. The low organic sediments had the low potential denitrification and mineralization rate so that the ammonium concentration was low, which might cause to lower the nitrification. In case of molecular experiment, while the bacteria amoA gene sequence responsible for nitrification did not observed in all fertilizer impacted sites, it was detected in un-impacted organic sediments. In case of archea amoA gene sequence, all sites were observed to have this sequence. For NirS and NirK gene coded in denitrifiers, NirS gene sequence was detected about all season sampling at most of the sites; however NirK gene sequence was not. Therefore, each sediment in the impacted and un-impacted tributaries is expected to have various microbial groups related to denitrification and nitrification.

(6) Okeechobee Isolated Wetlands: Influences of Hydroperiod and Grazing on Vegetation

J. Neumann
Advisor: M. Clark

The Lake Okeechobee agroecological watershed has been implicated as a contributor to eutrophication of the lake and numerous efforts and Best Management Practices are being implemented to meet the target phosphorus (P) TMDL. Many of these programs are public-private partnerships cost sharing equipment or structural changes to improve management. A new type of public-private partnership is being evaluated in the Okeechobee basin, one where ranch owners could be monetarily compensated for the water they store, wildlife habitat they provide and P they retain over and above what they are already required to do. The Florida Ranchlands Environmental Services Project (FRESP) is a partnership of stated, federal, and private parties that will evaluate the environmental benefit and financial feasibility of this concept. One critical part of FRESP will be the development of a low cost quantitative method to document the environmental services provided that is also transparent to both buyer and seller of the service. One service to be compensated is any increase in wildlife habitat, which in this case will be measured by an increase in area of wetland plant species. However, ranch owners are also interested in any potential losses of pasture carrying capacity due to changes in forage species. To address these questions, this study will investigate a) how vegetation species and diversity are related to changes in wetland and adjacent pasture hydrology, b) how forage species are affected by the duration and frequency of flooding, and c) what the influence of cattle is on vegetation species composition. We will also be investigating a rapid field assessment methodology first developed for underwater surveys of coral. The program Coral Point Count with Excel extension (CPCe) is a photo processing tool that facilitates image interpretation for species composition, percent cover and general ecological population statistics. FRESP partner ranchers were instrumented in the Fall of 2006 and initial vegetation surveys were conducted at that time. Other investigations have monitored hydrology and vegetation in four wetlands since 2004, and that data is presented as an initial evaluation of the CPCe method for preliminary results.

(7) Validation of a Multi-Criteria Decision Model for Water Resources Planning

J. Padowski
Advisor: J. Jawitz

The sustainability of water resources has become a growing concern on both local and global scales. As populations increase, the availability and accessibility of these resources is reduced due to both higher demand and poor resource management. Careful management is crucial for future availability, however there is often a disconnect between scientists and managers that makes it difficult for scientific knowledge to be used meaningfully in the decision-making process. Management decision support models are potentially useful tools for bridging this gap, particularly in the area of water resources.

We have developed a water supply decision support model for the Palm Beach County Water Utility District (PBCWUD) by combining a hydrologic model with multi-criteria decision analysis (MCDA). This work described an inverse modelling case study to validate the combined hydrologic and decision model against historical data from the Wakodahatchee Wetlands, a project owned and constructed by the PBCWUD. Specific elements evaluated in this case study include water supply and wastewater discharge, and economic and regulatory factors contributing to management decisions. Validation was performed using the Water Evaluation And Planning System (WEAP) hydrologic model and three types of MCDA ranking methods: the Weighted-Average Method, PROMETHEE Method and the Discrete Compromise Programming Method. WEAP was used to simulate the hydrologic effects of each alternative, and the MCDA ranking methods were used to weight and evaluate the combined hydrologic, economic, and regulatory criteria for each alternative project.

(8) Modeling Phosphorus Reactions and Transformations in a Submerged Aquatic Vegetation Dominated Wetland

R. Paudel
Advisor: J. Jawitz

This study describes the development of the spatially distributed water quality model to describe phosphorus (P) mobility in Cell 4 of Storm Water Treatment Area 1 West (STA 1W) in South Florida. STA 1 W is used as buffers to reduce the P in agricultural runoff before entering the adjacent Water Conservation Areas (WCAs). Cell 4 of STA1W was designed to be dominated by submerged aquatic vegetation (SAV). Historic data from 1995-2000 are evaluated here. The model is based on primary mechanisms regulating P behavior in soils, water column and biomass. Hydrologic information is important to simulate biogeochemical processes as it is needed to calculate material transport tracking the mobile components. In order to provide the hydrologic data necessary to simulate chemical transport, the model is linked with the South Florida Water Management District Regional Simulation Model (SFWMD/RSM). Water flow distribution and velocity were simulated and compared with results of the non-reactive tracer study (Rhodamine-WT dye) described by Dierberg et al. (2004). Coupled simulations of water flow and P biogeochemical processes were performed at different spatial and temporal scales. At present, these processes are modeled with simple uptake and release parameters between stores (water column and soil) and model complexity will be further increased to look at more detailed and complex processes in the future. Additional complexity increases the number of processes and their functional relationships. Such models may provide tools to answer various questions progressively along a spectrum of temporal and spatial scales and degree of details for transport and cycling of P within SAV dominated wetlands.

(9) The Role of Long-Term Forest Management in Soil Aggregation and Soil Organic Matter Storage in a Sandy Soil of the Coastal Plain

E. Azuaje
Advisor: N. Comerford

Chemical weed control is a common and effective forest management practice in southeastern sandy soils; yet it may decrease soil organic matter (SOM) in the surface soil of managed forests. Preliminary work on soil aggregation has shown that approximately half of the SOC is held in microaggregates that appear to be influenced by rooting. The objective of this study was to determine to what degree total weed removal and subsequent forest productivity influenced soil aggregation and SOC storage in an 18-year old Pinus taeda plantation growing on a Spodosol near Gainesville, FL. The studies treatments were: control and sustained weed removal. Soil samples, taken from three replicates of each treatment, were dry-sieved into 4 size fractions. Soil aggregation and aggregate stability of the largest three size fractions were measured by sonication. Aggregate organic matter was measured by loss on ignition as aggregates were destroyed by sonication. When aggregate organic matter was expressed as percent of total soil organic matter in a soil fraction (AOM%), weed removal increased the AOM% only within aggregates with high stabilization energies. There was also a difference among size fractions in the portion of total OM that was incorporated into microaggregates. The 250 to 150 micron fraction had the highest portion of aggregate OM, followed by the 150 to 53 micron fractions, with the 2000 to 250 micron fraction having the lowest amount. When aggregate organic matter was expressed as g OM per g of soil fraction (AOMg), it was clear that more aggregate organic matter was found in the weed removal treatment. That treatment resulted in more OM incorporated into high stability aggregates. More AOMg was found in the weed removal treatment within the 2000 to 250 and 150 to 53 micron size fractions. Therefore, the weed removal treatment, operating over 18 years clearly increased both the AOMg and the AOPM% held within the most stable aggregates. Weed removal at least doubled the above-ground growth of loblolly pine. Weed removal increased above ground litter input, but the effect on root amount and turnover over that period is currently unknown. What is causing the higher stability of aggregates in which more AOMg is incorporated under weed removal is also unknown. These data potentially conflict with two published reports from the southeast where weed removal as a forest management practice decreased soil organic carbon. They argue for investigating the controls on aggregate stability and how pine root inputs differ from understory plant inputs in the development of stable aggregates in these uniquely sandy soils.

(10) GIS-based Assessment of Soil Carbon Storage Along Soil-Land Use Trajectories

N. DiGruttolo
Advisor: S. Grunwald

Carbon sequestration refers to the provision of long-term storage of carbon in the terrestrial biosphere, underground, or in the oceans so that the buildup of anthropogenic CO2 concentration in the atmosphere will reduce or slow. Potential carbon sequestration is defined by factors which set the physico-chemical maximum limit to storage (e.g. mineralogy, depth). The attainable carbon sequestration is set by factors that limit the input of carbon to the soil system (e.g. climate, vegetation, land use). The actual carbon storage is set by factors that reduce carbon storage (e.g. drainage, tillage) and depend on environmental landscape factors that form soil carbon. Soil carbon is a function of multiple interrelated factors including climate - hydrology and temperature; land cover/biomass; land use management; organisms; soils; parent material; topography; and natural and anthropogenic stressors. Our objectives were to: (1) derive an actual soil carbon inventory for a large watershed in north-east Florida covering different ecosystem types, (2) assess trends in soil carbon storage along soil-land use trajectories (1995-2003), and (3) generate scenarios to address attainable carbon sequestration based on land use shifts/management.

We used 546 soil samples collected at 4 different depths (0-30, 30-60, 60-120 and 120-180 cm) within the Santa Fe River Watershed (SFRW) [size: 3,585 km2] in north-east Florida. Soil sampling locations were selected based on a stratified random sampling design representing typical soil-land use combinations. Soil samples were analyzed for total carbon (TC) by combustion using a Thermo-Finnigan Flash EA1112 elemental analyzer. Soil-land use factor combinations were used to delineate TC means and standard deviations. The ArcGIS Geographic Information System was used to superimpose soil unit boundaries (orders) from the Soil Data Mart (NRCS database) and land use (2003) derived from Landsat ETM satellite images (Florida Fish and Wildlife Conservation Commission). In the SFRW the soil orders Ultisols (54.4%), Spodosols (17.8%), Entisols (16.3%), Alfisols (4.7%), Histosols (4.7%), Inceptisols (0.4%), and water (1.8%) are found. Land use (2003) was pinelands (30.1%), wetlands (13.8%), rangelands (12.5%), upland forest (12.5%), urban (11.0%), row crops (4.6%), open water (1.8%), and other agriculture (0.8%). Bulk density data for different soil types in the SFRW were derived from the Florida Soil Characterization Dataset using a profile reconstruction technique. Bulk densities and TC concentrations were multiplied for each layer to derive TC storage in kg m-2. Layers were aggregated to derive TC storage up to a soil profile depth of 180 cm. Soil-land use combinations were derived from GIS maps and populated with TC values for each soil layer. Raster maps were produced to show the spatial distribution of soil TC across the whole watershed. To assess the effect of land use change on TC storage a backcasting GIS techniques was used to compare change in soil carbon between 1995 and 2003.

Total carbon ranged from less than 0.5 to 61 kg m-2. A total of 16.513, 6.576, 7.888 and 4.549 million metric tons of carbon were stored in 0-30, 30-60, 60-120 and 120-180 cm depth within the watershed. High average carbon stocks were found on Spodosols and wetlands. If soils become a sink or source for carbon depends on land use shifts and management among multiple other environmental landscape factors that control carbon cycling.

(11) Nutrient Availability in Soil After Invasion and Treatment of *Melaleuca quinquenervia*

K. Roberts
Advisor: K. R. Reddy & M. Martin

Invasive species are a growing concern because of their ability to change ecosystem dynamics and threaten ecosystem stability. Melaleuca quinquenervia (Cav.) Blake (hereafter referred to as melaleuca) is an invasive tree species that is causing serious problems in Florida, Texas, Louisiana, and California. Melaleuca trees form very dense monocultures stands that displace native plants and animals, alter soil, and disturb natural water flow. In addition melaleuca infested forests are prone to canopy fires that can damage or kill native plant species.

Several treatment methods have been developed to control melaleuca. These include biological control and the use of herbicides. Research has been done investigating these treatment methods and their effect on the melaleuca populations. However, very few studies have investigated how the treatment methods affect ecosystem function. My research tests how melaleuca invasion and treatment affects soil microbial community composition and function. Soils were collected from three areas: a native plant-dominated area, melaleuca-dominated area with biological control, and a melaleuca-dominated area controlled with herbicides. An incubation study was developed according to a method described in Grierson et al. (1999) to measure specifically mineralizable phosphorus levels, an index of nutrient availability. This study will be used to determine which of the current treatment methods is optimal for melaleuca control with respect to the health of the native environment.

(12) Nutrient Retention of Spodosols in an Impacted Isolated Wetland

J. Bhadha
Advisor: J. Jawitz

Agricultural soils within the Lake Okeechobee drainage basin can pose a nutrient management challenge because of their low nutrient retention capacity and hydrological setting. While hydrological restoration of isolated wetlands within the hydroscape may mitigate some phosphorus (P) loss from pastures, P retention mechanisms within these wetlands are difficult to control, and depend primarily on vegetation, antecedent soil conditions, and climate. The objective of this research was to: (i) Characterize soil properties responsible for nutrient retention such as, texture, bulk density, particle density, porosity, soil organic matter (OM) and total P (TP) concentrations, and distinct hydric soil indicators; and (ii) Use steady-state diagenetic equations to describe the effect of physical and biological processes using a low authigenic phosphate (PO4) precipitation rate on measured soil pore water profiles.

Results indicate that the spodosols exhibit a modified A-horizon within the upper few centimeters, a sandy illuviated E-horizon, a loamy Bt- horizon interspersed with Fe-Al redoximorphic features, a Bh-horizon with slightly higher soil TP concentrations, contained over a high density-low conductivity argillic clay horizon, and at least three distinct hydric soil indicators observed within the top 15 cm. An inverse relationship between porosity (17-50 %) and bulk density (0.8-2.2 g/cm3) was attributed to physical stresses such as tillage and compaction. Based on the strong correlation between soil OM and TP we conclude that a large fraction of the soil P is organic based, and not derived from inorganic agricultural amendments. However, the low sorption capacity of P by spodosols can pose a threat to downstream aquatic systems through ground water pathways, restricted only by the presence of semi-confining clayey horizons (below 120 cm depth) that may behave as preferential flow paths, and possibly retaining some of the P from solution onto its reaction sites. Lastly, pore water PO4 concentrations could not be explained using steady-state diagenetic equations in the upper 30 cm, however, below 30 cm observed pore water PO4 concentrations could be a result of antecedent soil conditions, and a slow precipitation rate of phosphatic minerals.

(13) Spatio-Temporal Patterns of Soil Charecteristics in Wet Longleaf Pine Flats Along Florida's Gulf Coast

G. McCaskill
Advisor: A. Ogram

Longleaf pine dominated wet pine flats are distinguished from mesic flatwoods or sandhills by the presence of long periods of flooding. This flooding causes changes in the biogeochemical cycling of nutrients, especially nitrogen. We examined soil chemical and biological properties along a chronosequence representing120 years. Soil pH, organic matter (SOM), nitrogen mineralization, available phosphorus, microbial biomass carbon, nitrifying bacteria, and fungal biomass were quantified for two years.

Results indicated that forest soils during early stand development had significantly higher levels of nitrifying bacteria than soils from mature longleaf pine flats. Soil organic matter and plant available phosphorus decreased through the mid-successional time interval, and then leveled off during the mature time interval on the 120-year chronosequence. Microbial biomass increased between the regeneration and mid-successional time intervals, and decreased between the mid-successional and mature time intervals. Nitrogen mineralization patterns closely reflected microbial biomass. The fungal biomass continued to increase over time, even with a decrease in the overall microbial biomass during the mature time interval.

Although the temporal pattern was strong in our analysis, a spatial pattern with respect to soil water content also emerged. For example, soil pH decreased along a soil moisture gradient from mesic flatwoods to the wet savannas, causing reductions in the microbial biomass C and nitrification rates. The fungal biomass was not significantly affected by increasing soil water content. Levels of SOM increased as soil water content increased to the point of flooding. Nitrogen mineralization was dominated by ammonium production, with little production in the form of nitrate in the highly flooded soils. The results indicate that soil chemical and biological properties change significantly with respect to stand developmental stage and soil water content in longleaf pine dominated wet pine flats.

(14) The Relative Contribution of Organic Matter Inputs to Surface Soil Carbon

K. Epps
Advisor: N. Comerford

The relative significance of aboveground and belowground inputs to soil carbon (quantity and quality) is important in determining management strategies for the maintenance and sequestration of soil carbon in forested systems. A comparison was made between the spectral signatures of three forms of organic matter inputs (foliage, litter and roots) and their respective surface soils at two depths (0-5 and 5-10 cm) using diffuse reflectance infrared Fourier transform spectroscopy applied to 18 single-species plots of tropical forest species. The sum of squared differences (SSD) was computed between the spectra of ground soil and each of the three carbon input forms and simple graphical analysis was used to gauge the proximity (similarity) between soil spectra and organic input spectra. Values of the SSD calculated from roots were plotted against those of litter and foliage The clustering of points below the y=x curve was used to indicate the greater similarity between the "dependent" variable and soil, while the test of the regression line best representing the points was used to determine the significance of its difference from unity or equal contribution. At the two depths, 0-5cm and 5-10cm, the slopes of root-SSD versus litter-SSD were β=0.24 and β=0.11, respectively, with the rejection of the alternative hypothesis that β =1 for both values at a confidence limit of 95%. A dependent t-test found no difference between the signals of roots at both depths. This analysis was repeated using ash-subtracted soil spectra – the result of the spectra of a non-combusted sample minus the spectra of an ashed sub-sample (combusted at 550°C for 5 hours), in order to minimize the signal of the mineral component of the soil present in the spectrum and to enhance the comparison between the soil organic matter and the carbon inputs. Results indicated that roots dominated at both depths with β=0.62 at the surface and β= 0.43 in the 5-10 cm depth. The data suggest a greater contribution of belowground inputs to soil organic matter than aboveground inputs, especially with increasing depth.

(15) Accumulation and Availability of Copper in Soils From Representative Citrus Groves in the Indian River Area

J. Fan
Advisors: Z. He & L. Ma

High copper (Cu) concentrations (>300 mg kg-1) were detected in the sediments of St. Lucie Estuary, which may have negative impacts on water quality and ecosystem functions. Transport of Cu from land to surface water systems through surface runoff water has been suspected to be one of the nonpoint sources in the Indian River area. The concentrations and loads of Cu in runoff water from agricultural field were found to relate to soil Cu accumulation, due to repeated use of Cu-containing fungicides. However, minimal information is available regarding the accumulation and availability of Cu in soils under citrus production system, which has received increasing amounts of Cu-fungicides in recent years to fight against canker and greening diseases. In this study, soil samples were collected from representative commercial citrus groves in the Indian River area. These samples were characterized to understand the accumulation and availability of Cu in the soils, as affected by soil properties, citrus growing history, and Cu-fungicide inputs.

Total recoverable Cu in the soils ranged from 4.7 to 228.5 mg kg-1, with an average of 60.0 mg kg-1, which is much higher than background level of agricultural soils (20-30 mg kg-1). Soil available Cu as estimated by Mehlich 3 was in the range of 2.2 to 119.1 mg kg-1, with an average of 31.3 mg kg-1, and was significantly correlated with total recoverable Cu ($P<0.001$). Both total recoverable and Mehlich 3 extractable Cu were significantly related to Cu input and citrus growing history. These results indicate that anthropogenic input of Cu through the use of Cu-fungicides and -fertilizers is the major factor that causes the accumulation and increased availability of Cu in the soils under citrus production.

(16) Bio-degradation of Pesticides (DDX Compounds) Using Organic and Inorganic Substrates and Enrichment of Dechlorinating Species

H. Gohil
Advisor: A. Ogram

The North-shore region of Lake Apopka is contaminated with DDT (2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane) and its persistent metabolites DDE (2,2-bis(p-chlorophenyl)-1,1-dichloroethylene) and DDD ((1,1-dichloro-2,2-bis(p-chlorophenyl)-ethane) (DDX). This causes a major ecological concern because of the toxicity and potential for biomagnification in the food chain. Although bio-remediation remains a potential option, the DDX molecules through aging decreases bioavailability by diffusing into the soil organic matrix. The reason for its stability in soil is its high hydrophobicity, chlorine substituents and low bio-availability.

An attempt here will be made to optimize bioavailability by various strategies including use of NaCl as a dispersant and use of synthetic and a natural surfactant (fruits from Sapindus mukorossi). Enrichment, isolation and identification of the degrading species or consortia will also be attempted. This knowledge can be further applied at field level but requires stimulation of desirable organisms by introduction of suitable electron donor and acceptor combination and addition of adequate nutrients to meet requirements of dechlorinating species. Hence studies promoting selective growth of such dechlorinators will be conducted.

(17) Estimation of Release Properties of Slow-Release Fertilizer Materials

L. Medina
Advisor: T. Obreza

Slow-release fertilizers marketed to the public usually include a claim that nutrient release will last for a specific time period, e.g. 6, 9, or 12 months. However, no official laboratory method exists that can verify these claims. A long-term (180-d) incubation method has been developed that produces constants for an exponential model that characterizes nutrient release as a function of time. In addition, a relatively short-term (74 hr) extraction method has been developed to assess nutrient release under accelerated laboratory conditions. Through regression techniques, release constants established for individual slow-release nutrient sources by the incubation method are used in conjunction with the laboratory extraction data to verify the release claims of slow-release fertilizers. Nutrient release for selected single materials has been predicted with greater than 90% accuracy. Nutrient release from mixtures of slow-release products has been more variable. It is typical for water-soluble and slow-release fertilizers to be mixed in commercial products. Successes and failures in predicting nutrient release from mixtures of soluble and slow-release nutrient sources will be discussed in detail. Ultimately, it is intended that these methodologies will be accepted as an official method to verify nutrient release claims placed on slow-release fertilizers.

(18) Characterizing the Relative Phytoavailability and Environmental Lability of Residual Biosolids-P

M. Miller
Advisor: G. O'Connor

Biosolids can serve as an agronomically valuable P-source: however, there is concern that land application these materials can potentially accelerate cultural eutrophication of surface waters if P migrates offsite. Previous short-term studies have successfully distinguished the release characteristics of biosolids-P from highly soluble inorganic fertilizer sources, and illustrated how various biosolids have vastly different P release characteristics. However, the studies failed to ascertain the ultimate fate of biosolids-P. A greenhouse study is underway to characterize the residual phytoavailability and environmental lability of biosolids-P and to provide understanding of the long-term fate of biosolids-P. Preliminary results from ten bahiagrass harvests and column leachings-representing 400 days of bahiagrass growth-show clear differences in residual P value among P-sources. The phytoavailability of residual biosolids-P from biological P removal (BPR) and BPR-like materials is similar to that of TSP. Residual biosolids-P from low soluble P materials (heat-dried, high Fe+Al biosolids, such as Milorganite) is substantially less environmentally labile and phytoavailable than TSP, and BPR and BPR-like biosolids. Long-term column leaching data suggest TSP-P is more environmentally labile than biosolids-P.

(34) Tissue Phosphorus Testing as a Vital Component in Bahiagrass Fertilization Programs in Florida

A. Obour
Advisor: M. Silveira

The response of bahiagrass (Paspalum notatum) to P fertilization in Florida has not been fully understood. Some previous studies in Florida indicated no yield responses to P application even though the soil tested low in Mehlich 1 P. Other studies, however, have shown that P fertilization can increase bahiagrass yields. This disagreement is due in part to the inability of soil tests to accurately predict forage nutrient requirements. There is an urgent need to develop additional testing procedures besides soil test to better predict bahiagrass P requirements. Bahiagrass tissue P testing may provide a vital link between crop response and P application. The objective of this research was to evaluate the minimal bahiagrass tissue P concentration below which forage yield is dramatically reduced. A greenhouse study was conducted at the UF/IFAS range cattle research center, Ona, in the winter of 2006 with three N rates and four P rates. After six harvests, bahiagrass DMY increased with increased P rate for each N rate. Tissue P also increased with increased P application at each N rate. A graph of tissue P by DMY showed that the critical tissue P concentration below which dry matter production is severely impaired is 1.5 g kg-1. Above tissue P concentration of 2.0 g kg-1 bahiagrass does not respond to P fertilization. Based on this study, we proposed the inclusion of tissue testing as supplemental analysis to soil test in bahiagrass P fertilization programs in Florida.

(20) Florida Soil Carbon Inventory

G. Vasques
Advisor: S. Grunwald

Whoa! Florida soils store 2,256 million tons of organic carbon. What does this mean in context of Florida's carbon budget? It has been estimated that the global soil carbon pool is four times the biotic pool and about three times the atmospheric pool providing ample opportunities to sequester carbon. Given the unique landscape, hydrologic and land use conditions, Florida soils have a larger sequestration potential when compared to other U.S. States. Thus, it is critical to assess current soil carbon stocks across Florida and their carbon sequestration potential to provide input for evolving carbon trading systems and markets.

Our objective was to develop a soil carbon inventory for Florida. With wetlands covering about 28%, organic matter-rich Histosols occupying about 10%, and Spodosols covering 30% of the State, Florida soils represent a vast storage deposit for soil organic carbon (SOC) that may be boosted by land use practices and hydrologic manipulation.

We used depth-weighted average SOC calculated from 970 detailed soil profiles of the Florida Soil Characterization Dataset, with an average maximum total profile depth of 176 cm. The National Resource Conservation Service's STATSGO database was used to derive soil orders and map unit boundaries. Depth-weighted average SOC values were attributed to each soil order to produce a rough estimate of total SOC in Florida.

Average SOC was 11.64 kg m-2. Minimum and maximum SOC per soil profile were 0.26 and 174.20 kg m-2, respectively. Soil organic carbon by soil order varied from 5.99 kg
m-2 for Entisols to 60.95 kg m-2 for Histosols, with Spodosols averaging 16.14 kg m-2. Soil organic carbon in the State of Florida totaled 2.256 Pg.

Protecting the organic carbon that has accumulated in the soil through millennia and increasing the SOC will be critical for a sustainable Florida soil-landscape that coevolves under anthropogenic (e.g. land use shifts) and natural stresses (e.g. hurricanes, wildfire). A dual landscape management approach that accounts for economic profitability and positive environmental co-effects (e.g. soil carbon sequestration) has the potential to make soils a marketable commodity.

(21) Land Use Effects on Soil Nutrient Cycling and Microbial Community Dynamics in the Everglades Agricultural Area, Florida

R. Ye
Advisor: A. Wright

Net results of the physical-chemical-biological interactions in the soil may largely shape the way an ecosystem functions with respect to nutrient cycling and the soil microbial community. The objective is to investigate impacts of different land uses on the soil microbial structure and function and soil nutrient cycling in the Everglades Agriculture Area (EAA) of southern Florida. We compared the use of community level physiology profiles (CLPP), phospholipid fatty acid (PLFA) and extracellular enzymatic activities to quantify soil microbial community structure and activity across four different land uses: sugarcane cropping, turfgrass, pasture, and forest. We also compared the microbial biomass C, N, and P to further quantify the various species for different land uses. The results show that leucine aminopeptidase activity in the turfgrass soil (0-45 cm), being 3.3 mg g-1 h-1, was significantly higher than that of the other three land uses. The highest cellobiohydrolase activity was also found in the same turfgrass field, being 141.2 mg g-1 h-1, which was significantly different with those of the sugarcane and pasture soils. The potentially mineralizable nitrogen (PMN) was highest in the surface layer and decreased with the soil depth in all of the land uses. The PMN of sugarcane fields, being 1.9 mg g -1 d-1, were significantly lower than those of the forest, turfgrass, and pasture lands, being 7.6, 9.0 and 7.0 mg g -1 d-1 respectively. Microbial biomass carbon (MBC) was found significantly higher in both turfgrass and pasture soil, being 23.5 and 24.1 g kg-1, than that of the forest soil profile (0-45 cm), being 14.4 g kg-1. Turfgrass was also found to have highest microbial biomass nitrogen (MBN) and microbial biomass phosphorous (MBP), being 0.24 g kg-1 and 0.074.61 g kg-1 respectively, which were significantly different from that of the pasture land, and both forest and sugarcane soils respectively. Furthermore, the MBP in the pasture soil was significantly different with that of the sugarcane and forest soils. Compared to the forest and pasture field, the turfgrass soil has significantly less of the organic content, being 68.8%. However, the amount of DOC in the forest field was significantly less than that of the others, being 1.7 g kg-1, which was about 3 times less than the highest field of turfgrass. The distribution of the extractable NH4-N in the soil profile (0-45 cm) across these four land uses was significantly different, from highest to lowest were pasture, turfgrass, sugarcane and forest field, being 54.86, 34.45, 14.18, and 12.38 mg kg-1 respectively. However, the bioavailability of phosphorous was found highest in turfgrass field, being 100.62 mg kg-1, which was significantly different with that of the lowest in pasture field, being 19.96 mg kg-1. Analysis of the CLPP further demonstrated that land use history post a significant impact on microbial community structure and function. Long-term cultivation and fertilization altered nutrient distribution in soil, and increased organic matter turnover rates. Cultivation effects on soil pH altered the microbial community composition. Long-term P fertilization in soil cropped to sugarcane may have induced a nitrogen deficiency, while soils of other land uses experienced potential P deficiency.

(22) Nutrient Profiles and Nutrient Cycling within Algal Mats in Florida Springs

A. Albertin
Advisor: M. Clark & J. Sickman

The aquifers supplying water to Florida's more than 600 karst springs are susceptible to human activities and land use change. Nitrate levels have increased in most springs over the last 30 years and are often associated with the proliferation of nuisance macroalgal mats while phosphate levels have remained relatively stable. However, no quantitative relationship exists between nitrate concentrations and algal biomass to establish a protective nutrient criteria. Spring nutrient supply rates alone do not control the distribution of algae but nutrient re-supply from senescing algal biomass and spring sediments may help explain how large algal mats are sustained in springs with relatively low nutrient concentrations. The main objectives of this study were to 1) characterize nutrient and isotopic profiles of large Lyngbya wollei and Vaucheria spp. mats, the two most common species of macroalgae found in Florida Springs and 2) estimate advective movement of dissolved nutrients out of these mats. To accomplish this, we are analyzing mat internal dissolved nutrients and the stable isotopes of nitrate (δ15N and δ18O) using interstitial water samplers know as multisamplers. We also analyzed the isotopic composition of algal tissue and underlying sediment (δ15N and δ13C) and measured NaCl and Rhodamine dye tracer movement out of algal mats at Weeki Wachee, Manatee and Silver Glen Springs during spring and summer 2006. Initial findings show that there are strong nutrient gradients within Lyngbya wollei and Vaucheria sp. mats.

(23) Rethinking the Green Menace: Water Hyacinth's Ecosystem Services in a Florida Context

J. Evans
Advisor: A. Wilkie

Water hyacinth (Eichhornia crassipes) is an exotic aquatic plant present in many Florida water bodies. Due to historical problems associated with overgrowth, current management practices focus on the minimization of the plant through chemical herbicide programs. However, these practices are often associated with undesirable ecosystem consequences such as secondary nutrient release, algal blooms, and damage to populations of non-target species. Although exotic plants such as water hyacinth are most often considered in terms of negative ecological impacts and efficient control, many recent studies demonstrate the positive ecosystem services that water hyacinth can provide. Water hyacinths are widely known as one of the most effective aquatic plants for uptake of nutrients, heavy metals, organic compounds, and pesticides. Managed growth and harvest of water hyacinth is a well-recognized phytoremediation and ecosystem recovery strategy. Biomass utilization takes various forms, such as green manure, textile fiber, ruminant forage, and renewable energy production in the form of biogas and cellulosic ethanol. In addition, several studies indicate that water hyacinths can suppress nuisance algal blooms through several mechanisms, including shading, nutrient competition, allelopathy, root filtration, and habitat for algal grazers. In some Florida ecosystem contexts, water hyacinth provides critical forage resources for manatees and habitat for a number of rare fishes, apple snails, and crayfish. In light of this knowledge, opportunities may exist for alternative management of water hyacinth to preserve and restore ecosystem services in Florida.

(24) Quorum Sensing Disruption by Coral Mucus Isolated Bacteria and Its Role in Symbiosis

S. Halbig
Advisor: M. Teplitski

A coral holobiont is a three-way symbiosis between the polyp, unicellular algae, and resident bacteria. The goal of this project was to investigate the role of quorum sensing (QS) in structuring this symbiosis since it is known that QS contributes to the structuring and symbiotic function of host-microbial consortia. A collection of coral mucus-selected bacteria was screened for the isolates capable of disrupting quorum sensing in model reporter strains. Six coral mucus bacterial isolates with significant QS inhibitory activities were identified using 16srDNA. They were found to be Planococcus spp., Photobacteirum spp., Marinobacter spp., Agrobacteirum spp., Vibrio spp., and Caryophanon spp.. All the selected isolates disrupted QS-mediated production of violacein pigment in a C. violaceum reporter. Photobacterium spp, Marinobacter spp., Vibrio spp., and Caryophanon spp. inhibited QS responses from the LuxR-and Ahr-based reporters. These QS signal receptors form V. fisheri and Aeoromonas spp. are normally responsive to C4-HSL and 3-oxo-C6-HSL respectively. Photobacterium spp, Marinobacter spp., and Vibrio spp. also inhibited responses in the LasR controlled reporter that is normally responsive to 3-oxo-C12-HSL. Photobacterium spp. and Marinobacter spp. also secreted signals capable of inhibiting QS-mediated surface swarming in pathogenic Serraatia marcescens. We hypothesize that the bacteria recruited by the coral provide protection against potential pathogens by disrupting QS-controlled virulence gene expression.

(25) Influence of Leguminous Cover-Crops on Phosphorous Fractions on a Pervuian Amazon Soil

H. Hall
Advisor: Y. Li

Weathered tropical soils account for millions of hectares of land area. Nutrients in these soils have been depleted over time naturally or by continuous cultivation and harvest of plant products. It is possible that with conscientious management, fertility of these soils can be maintained or improved upon, making them a renewable resource. Leguminous cover crops are widely accepted for their contribution to soil quality – namely through additions of nitrogen. As phosphorus is often the most limited plant essential nutrient in tropical soils, inclusion of leguminous cover crops on these soils may seem counter-intuitive. However, leguminous cover crops can alter soil phosphorus forms through the addition of soil organic matter, deep soil mining, and microbial priming. The following poster presents an analysis of data collected from a randomized split plot design utilizing leguminous and non-leguminous cover crop treatments in Tarapoto, Peru. The main focus is on comparing soil phosphorus fractions after four years of growth in a cacao agroforestry system. The four leguminous species included are Arachis pintoi (perennial peanut), Calopogonium mucunoides (calopogonium), Canavalia ensiformis (jack bean), and Centrosema macrocarpum (macrocarpum). These treatments are compared to a non-leguminous cover crop, Callisia repens (turtle vine), and one unmanaged fallow, with and one without inorganic fertilizer additions. All treatments are replicated 3 times. Soil phosphorus was sequentially extracted into pools of inorganic and organic fractions. The potential roles of leguminous cover crops on increasing labile P in cacao agroforestry systems are discussed.

(26) Identification of Arsenic-Resistant Bacteria from Rhizosphere of *P. Vittata* Growing on an Arsenic-Contaminated Site

A. Huang
Advisor: L. Ma

This experiment was conducted to identify arsenic-resistant bacteria from an arsenic-contaminated site where arsenic hyperaccumulator Pteris vittata L. (Chinese Brake fern) grows. P vittata produces large quantity of root exudates, which solubilize arsenic from soils as well as maintain unique rhizosphere microbial communities. TYEG medium and NBRIP media with rock phosphate as the only P source were used to isolate bacteria from bulk and rhizosphere soils of P. vittata. Bacteria were streaked on plates containing 10, 50, 100, 200, 300 and 400mM of Na3AsO4. Arsenic-resistant bacteria were identified using 16s RNA gene method. Bacteria isolated from the rhizosphere tolerated as high as 400 mM arsenic (30,000 mg kg-1), the highest arsenic concentration reported to date. They were also much more tolerance to arsenic than those from the bulk soil. Bacteria using rock phosphate as P source were more sensitive to arsenic since phosphate is a chemical analog of arsenate. Most arsenic-resistant bacteria had a higher than 97% of similarity with Pseudomonas or Bacillus species.

(27) Carbon-Source Utilization of a Coral White Pox Pathogen, *Serratia marcescens*

C. Krediet
Advisor: M. Teplitski

The surface mucopolysaccharide layer (SML) secreted by corals is a rich environment where bacteria proliferate, with population levels often being several orders of magnitude higher than in the surrounding waters. Beneficial and pathogenic bacteria colonize the mucopolysaccharide layer. Colonization of coral SML and bacterial growth on coral mucus require specific regulatory genes and catabolic enzymes. Serratia marcescens is an opportunistic pathogen that causes the White Pox disease of elkhorn coral, Acropora palmata. To characterize mechanisms of SML colonization by S. marcescens, two approaches were used. First, a complement of enzymatic activities induced by growth coral mucus was identified using defined chromogenic (p-Nitrophenyl) substrates. pN -N-Acetyl-B-D-Galactosanide, pN -a-D-galactopyranoside, pN -a-D-glucopyranoside, pN -B-D-glucopyranoside and pN -a-L-fucopyranoside were induced after two hours of incubation of S. marcescens with coral mucus, while pN -B-D-galactopyranoside, pN -a-L-arabinopyranoside and pN -B-D-fucopyranoside required eighteen hours of incubation. An EcoPlate Biolog was then used to characterize the full repertoire of catabolic enzymes in S. marcescens. As a control, a plant pathogenic S. marcescens and a human isolate of the same species were also included in the Biolog test. The ability to utilize fourteen substrates was common to all isolates of S. marcescens. The coral pathogenic S. marcescens was able to utilize no additional substrates while the other two isolates were capable of metabolizing 13 additional carbon sources sources. The characterization of glycosidases required for growth on coral mucus demonstrates that Serratia marcescens relies on specific catabolic genes for its colonization of Acroporid corals. The repertoire of carbohydrate degrading enzymes in the coral pathogen is likely to be distinct from that of the human and plant pathogenic isolates.

(28) Nitrogen Nutritional Characteristics of Water Lettuce (*Pistia stratiotes*) and Salvinia (*Salvinia spp.*)

Q. Lu
Advisors: Z. He & D. Graetz

Because of their fast growth rates, simple growth requirements, and ability to accumulate biogenic elements and toxic substances, water lettuce (Pistia stratiotes) and salvinia (Salvinia spp.) are often planted for nutrient removal from stormwater in retention/detention water systems. Knowledge on plant nutritional characteristics, such as minimal, optimal, and maximal N and P requirement is needed for better management of these retention/detention water systems. Series of greenhouse hydroponic studies were conducting to characterize the nutrient requirement (N and P) of water lettuce and salvinia. For N characterization study, 7 levels of N (as NH4NO3): 0.005, 0.025, 0.05, 0.25, 1.25, 2.5, and 5 mg N L-1, were set up with 3 replications of each N treatment. Modified Hoagland solution was used as the cultured medium, which was renewed every 3 or 4 days. Periodic harvests were performed to avoid overcrowding and weights were recorded. After 44 days of growth, plants were harvested and oven dried and analyzed for N and other plant nutrients. One mature water lettuce plant was sampled from each pot for root morphologic analysis. Plant fresh weight of both water lettuce and salvinia increased with increasing N concentration in the culture solution. Significant relationship ($P<0.001$) between plant fresh weight and N concentration in the culture solution can be described with both linear and polynomial equations, with R2 of 0.90 and 0.97, respectively for water lettuce, and 0.83 and 0.86, respectively for salvinia. Plant N content increased with increasing N concentration in the culture solution in a linear trend. The critical N concentration for water lettuce growth was found to be 1.25 mg N L-1. Plant growth of water lettuce was not significant when N solution concentration is below this critical level. Salvinia plant required higher N level for normal growth, and a concentration of 2.5 mg N L-1 was needed in the culture solution for significant growth. There was no significant difference in water lettuce root morphology among different N treatments in terms of root length, root surface area, and root average diameter. Shoot/root ratio of plant biomass or N uptake was also a good indicator of plant nutrition status, with values >1 indicating normal growth of the plant.

(29) Effect of Arsenic on Scale Insect Infestation of Arsenic Hyperaccumulator *Pteris vittata L*

S. Mathews
Advisor: L. Ma

Arsenic hyperaccumulation by Pteris vittata (Chinese brake fern) may serve as a defense mechanism against herbivore attack. A study was conducted to examine the effects of arsenic concentrations (0, 5, 15 and 30 mg kg-1) on scale insect (Saissetia neglecta) infestation of P. vittata. Scale insects were counted as a percentage of fallen from the plant to the total number of insects after 1 week treatment. The arsenic concentrations in the fronds ranged from 5.40 to 812 mg kg-1. Greater arsenic concentrations resulted in higher percentage of fallen scale insects (17.2-55.0%). Lower arsenic concentrations (< 5 mgkg-1) showed significantly lower effect on the population compared to 15-30 mg kg-1 ($p<0.05$). Analysis of arsenic content of the scale insects indicated arsenic concentrations of 1-9 mg kg-1, which indicated that arsenic has been ingested via plant sap. Further research is needed to examine the evolution of hyperaccumulation, which may result from self-defense against biotic or abiotic stresses.

(30) *Euphorbia tirucalli* – A Potential Bioenergy Crop for Arid and Semi-Arid Climate Zones

S. Matthews
Advisor: A. Wilkie

Energy crops are an increasingly important source of renewable fuels in light of the impacts and projected decline of fossil fuels. There is a lack of data on low-input and xerophytic crops that won't compete with food and other resources. The objective of this study is to investigate the suitability of Euphorbia tirucalli for cultivation in arid and semi-arid climate zones. Euphorbia tirucalli is a succulent desert spurge native to East Africa noted for its rapid growth compared to other xerophytes and has a high hydrocarbon content resin. This study will measure differences in vegetative growth and quality as impacted by irrigation, nutrient addition, and soil texture. Vegetative quality will be measured through resin content and biomass yield will be determined on a dry weight basis at the end of the study. Different soil types analyzed will include clay loam, sandy loam and sand. Nutrient addition will consist of a water-soluble chemical fertilizer. Euphorbia tirucalli has the potential to provide arid zone inhabitants with an energy solution in the form of a high-quality biomass that can be converted to gaseous, liquid, or solid biofuels.

(31) Determining Historic Fire Frequency Interval for Coastal Scrub Habitat Restoration at the Guana Tolomato Matanzas National Estuarine Research Reserve in Northeastern Florida

K. Ratkus
Advisor: M. Clark

Forest fragmentation and wildfire suppression have changed how lighting strike ignited fires historically swept across Florida's landscape. Since wildfires are a dominant ecological driver in many of Florida's vegetation communities, fire suppression, has changed the woodland structure and plant species composition in many of our natural areas. The habitat restoration technique of undisturbed and fire suppressed coastal scrub, is to reintroduce fire in the landscape. In order to mimic this fire regime, land managers need to know how frequently to implement prescribed burns. The nature of oak scrub fires are normally a catastrophic event resulting in top killing and scorching most above ground vegetation. Immediately after a fire, surviving roots send out fresh sprouts and seeds germinate from the seed bank to re-establish a younger version of the burned vegetation. One method to determine fire frequency is to chronosequence non-lethal fire scars that remain on living trees as a record of historic fire events. Our dendropyrochonology study of the oak species at Guana Tolomato Matanzas National Estuarine Research Reserve (GTM Reserve) is investigating historic fire signatures to reconstruct this burn interval. This investigation has three main segments: 1) compare tree age with time since area was last burned 2) determine age of external tree burn scars and internal bark fissure pattern scarring on trees collected in GTM Reserve, and 3) conduct probability analysis of lightning strike and ignition using historic lightening strike data within GTM Reserve. Sampling at GTM Reserve in the summer of 2006 has provided tree cross-sections and increment cores of Quercus germinate, Quercus virginiana, Quercus chapmanii, and Quercus myrtifolia. Preliminary analysis suggest that dendropyrochonology may not be a viable method to assess fire frequency in these species of oaks or community type. However, findings are inconclusive at this point and require further analysis.

(32) Impact and Control of Organic Matter in USGA Ultradwarf Bermudagrass Greens

J. Rowland
Advisor: G. Snyder

Organic Matter (OM) impacts United States Golf Association (USGA) golf greens in various ways, both positive and negative. Without adequate OM greens will have reduced water and nutrient holding capacity due to excessive saturated hydraulic conductivity (Ksat), and a lack of cation exchange capacity. In contrast, greens with excessive OM may have such greatly reduced Ksat that the surface zone becomes waterlogged and anaerobic, resulting in a rapid decline of turfgrass. The bulk of research related to OM in golf greens has been conducted on bentgrass greens, due to the phenomenon of Summer Bentgrass Decline (SBD). Initially, SBD was thought to be caused by fungal pressure associated with extended periods of high temperature. Presently, researchers are focusing on the OM content of the root zone in relation to Ksat, and oxygen diffusion rates (ODR). When OM rises above 4% (by weight) the macropores (>0.075 mm) which facilitate oxygen diffusion can become clogged with OM, resulting in reductions of Ksat, soil oxygen levels, and oxygen diffusion rates. Extended high temperatures (>90° F), OM concentrations greater than 4% (by weight), and ODR below 0.20 micrograms O2 cm^{-2} min^{-1} in the surface inch, are now believed to trigger the decline of bentgrass greens. Currently, only limited research has been conducted on establishing parameters for OM in USGA ultradwarf bermudagrass greens. To assume OM levels recommended for USGA bentgrass greens directly correlate to USGA ultradwarf bermudagrass greens (especially in South Florida), could be a mistake. Therefore, a two-part study incorporating cultural practices, and the examination of soil physical properties, was performed on the FLREC ultradwarf research green. Various levels and types of aerification and verticutting, compared to a control, were evaluated for quality, recovery, and compressibility. OM, Ksat, bulk density, relative density, pore space, CO2 flux, and water holding capacity were measured for each treatment. Data obtained is being used to determine the effects of cultural practices on soil physical properties and their relationship to ultradwarf bermudagrass quality.

(33) The Influence of Nitrogen Source and Application Timing on NO3-N Leaching from a St. Augustinegrass Lawn Environment

N. Young
Advisor: G. Snyder

Residential lawns have been proposed as a potential contributor to NO3-N water contamination, where routine fertilization may serve as a source of Nitrogen (N) runoff and leaching into surrounding watersheds. Recent research examining this paradigm indicates low NO3-N leaching potential from St. Augustinegrass [Stenotaphrum secundatum (Walt.) Kuntze], under judicious management. However, few studies have examined NO3-N leaching from slow release N sources applied to St. Augustinegrass. Therefore, a field experiment was initiated on April 30th, 2007 utilizing a facility containing 36, 2 x 4m research plots, at the University of Florida's (UF) Fort Lauderdale Research and Education Center to investigate NO3-N leaching from a 'Floratam' St. Augustinegrass lawn. Twelve fertilizer treatments, replicated 3 times in a randomized block design, are currently under investigation. Milorganite (6-2-0), Polyon 42 (42-0-0), and Nitamin 30L (30-0-0) fertilizers are applied six times per annum (TPA), four TPA, and two TPA at 49, 98, and 146 kg N ha-1, respectively per application so each treatment receives the same amount of N annually. Nitamin 30L was the only treatment applied as a liquid, employed to simulate commercial application approaches. Urea (46-0-0), applied six TPA at 49 kg N ha-1 and 50:50 combination of urea and Polyon 42 applied six TPA and four TPA at 49 and 98 kg N ha-1, respectively, are also being evaluated. Percolate water samples are taken and processed according to DEP QA/QC protocol and analyzed by UF Gainesville laboratory for NO3-N and ortho-P. Water samples are collected twice weekly or following precipitation exceeding 25 mm. St. Augustinegrass response to the fertilizer regimes are determined by monthly color, quality, and bimonthly density ratings, on a 1-to-9 scale, 9 (best color/quality/density possible), 1 (dead turf), and 6 (acceptable color/quality/density). Turfgrass clippings samples are also taken at a 75 mm height of cut approximately weekly to evaluate treatment affects on shoot growth.

(34) Predicting Reduction in Phosphorus Storage Capacity Over Time in Soils with Manure Additions

M. Chrysostome, V. Nair

Phosphorus (P) concentrations in agricultural soils have substantially increased in the last decades, increasing the risks for surface and ground water contamination through P runoff and leaching. In sandy soils, the potential for P leaching is greater, especially in areas of intensive animal agriculture. The purpose of this study is to assess the reduction in P storage capacity at a site in the Suwannee River Basin (Florida and Georgia) receiving poultry manure additions. Four soil profiles in fields amended with poultry manure were sampled by horizon three times over 36 months. Initial P concentrations were low (less than 40 mg Mehlich 1-P kg-1). Approximately 82 mg P kg-1 were added to the soils between the first and the third sampling periods. Physical and chemical characteristics of the soils were determined, including water soluble P (WSP), oxalate extractable P, Al, Fe, and Mehlich 1-P. The P saturation ratio (PSR) was calculated as the molar ratio of oxalate extractable P to oxalate extractable Fe and Al. The soil P storage capacity (SPSC) was calculated for individual horizon and by profile, using a PSR threshold of 0.15. The SPSC refers to the amount of P that can be safely added to a certain volume or mass of soil before the soil becomes a P source. The analysis of the surface horizon of the profiles showed an average SPSC decrease from -23 mg P kg-1 to -54 mg P kg-1 after the third sampling. The results also showed average decreases in SPSC (31%) for the entire profile and corresponding average increases in WSP (131%) and Mehlich 1-P (180%) over the three-year period. SPSC can be used to predict site-specific safe P-loading for sandy soils.

(35) Nutrient and Contaminant Cycling in Impacted Ecosystems

E. Dunne, M. Clark, K. R. Reddy
Wetland Biogeochemistry Laboratory

Our research within impacted ecosystems specifically focuses on how biogeochemical and ecological processes can be used to help restore, conserve and protect soil and water quality. At present, we have externally funded projects that are: evaluating the effect of restoring hydrology to small (< 3 ha) wetlands within agricultural pasture land to store water and retain phosphorus; evaluating and demonstrating the efficacy of ecologically engineered systems to dentrify nitrate contaminated surficial groundwater in impaired waterbodies; reviewing soil, water and vegetation data sets to evaluate changes in wetland ecosystem components to offer quantitative insights into more effective large-scale treatment wetland management. There are exciting opportunities for undergraduate and graduate students that are interested in applying biogeochemical and ecological processes to management of soil and water resources.

(36) Effects of Phosphate Amendments on Pb Leachability in Florida Shooting Range Soils

A. Fayiga, U. Saha, L. Ma

Phosphate-induced Pb immobilization in shooting range soils is a cost-effective way to prevent and minimize Pb migration and subsequent environmental pollution. This study evaluated the efficacy of phosphate rock and phosphoric acid to immobilize lead in shooting ranges using column experiments. Phosphate was applied at a molar ratio of P/Pb=4:1, with 2/3 being phosphate rock (PR) and 1/3 phosphoric acid (PA). Leaching was done in two stages with toxicity characterization procedure (TCLP) and synthetic precipitation leaching procedure (SPLP) fluids. Even though there was a >90% decrease in Pb leached from P-treated soils, the treatment effectively reduced TCLP Pb to below 5 mg/L in only two of the shooting ranges tested. There was initially a fast release of Pb with TCLP fluid followed by a slow release in untreated shooting range soils. The metal release was positively correlated to the pH of the leachates suggesting a proton-induced mineral desorption and dissolution.

(37) Impact of Lime and Phosphate Rock on Pb Mobility and Cycling in Vegetated Shooting Range Soils

A. Fayiga, U. Saha, L. Ma

This experiment attempts to determine the effects of vegetation (St. Augustine), lime and phosphate rock (PR) on lead mobility, uptake and cycling in two shooting range soils. 5% PR and lime were added, mixed and incubated with water for one week before planting the grass. Leachates and samples of plant and soil were collected at 1-3 months intervals and analyzed for Pb. The harvested plant biomass was weighed and reincorporated back into the soil. Water-soluble Pb was significantly correlated to DOC concentration of the leachates suggesting that Pb release in the soil could be due to mobilization of organic Pb complexes in the soil. Soil amendments reduced plant Pb uptake from 90mg/kg to 45 – 47 mg/kg in range A and from 60mg/kg to 46 – 47 mg/kg in range B after three months of planting. Lead in shoots was significantly correlated with Pb in leachates from the soil. Both lime and PR reduced leachable lead from the soil in both ranges. PR addition was most effective in reducing leachable Pb in range A and lime was most effective for range B. This further emphasizes site specific remediation measures for lead polluted soils.

(38) Integrated Ecological Assessment in Wetlands: The Everglades

H. Fitz

The Everglades Landscape Model (ELM, http://my.sfwmd.gov/elm) is a spatially distributed simulation model of integrated ecosystem processes within the mosaic of habitats of the greater Everglades. Development and refinement of this modeling framework has focused on synthesis of fundamental ecosystem processes, extrapolating research insights of local scale dynamics into broader spatial and temporal scales. The model integrates the direct and indirect interactions among simple code modules of hydrology, nutrients, soils, periphyton, macrophytes, and habitat succession. Carbon, phosphorus, and water are state variables that are tracked through space and time. In assembling a complex system from these flexible modules, the scaleable framework of the Open Source ELM is a collaboration tool to investigate research and management hypotheses involving landscape change. While recent refinements have been specific to Everglades applications, a generic design has been maintained so that the modeled processes are applicable to a range of wetland and upland ecosystems. In its regional (~10,000 km2) application at 1 km2 grid resolution, the current ELM v2.5 is available to assess relative differences in ecological performance of Everglades management plans - at decadal time scales. Hydrologic performance of the ELM within the Everglades is comparable to the South Florida Water Management Model, the primary management planning tool in the region. While consistency with that model is important, the focus of ELM is on the associated ecological assessment. Several model Performance Measures may be used in this model version. These include phosphorus (P) concentration in the surface water, and net P accumulation in the ecosystem. Extensive data are available for calibrating-validating surface water P concentrations; during a 2-decade period, the model had a 1 ug/L median bias in predictions within the marshes. Predicted P accumulation along a steep eutrophication gradient showed a high degree of concordance with estimates from radionuclide markers. With other predicted ecological attributes and rates being consistent with available observations, there is strong evidence of model skill in predicting eutrophication trends across the scales of interest in Everglades landscape analysis.

Hydrology and nutrient dynamics are fundamental drivers of the Everglades ecology. However, the primary goals of the ELM involve assessing additional measures of ecosystem performance. Using the same model code and parameters, finer-scaled applications in specific subregions are the principal test beds for assimilating advances in process-oriented ecological research. One of the newer such model-research applications is a Ridge & Slough pattern-process simulation at multiple grid scales (250 m, 125 m, and soon, 50 m grid resolutions). That model showed how ecosystem feedbacks can maintain the anisotropic pattern of Everglades peatlands over century time scales. In other efforts, field studies are targeting some of the uncertainties associated with the recovery of severely- eutrophic areas. Hierarchical sensitivity analyses have confirmed the importance of the rate processes associated with soils, including the contributions from the overlying floc layer. Continued advancements in understanding these interactions, in combination with understanding the effects of water flows, will enhance our insights into restoration potentials – which can be extrapolated across larger spatio-temporal scales via simulation.

(39) Soil Carbon Sequestration and Stabilization in Tree-Based Pasture Systems of Florida

S. Haile, V. Nair

Compared to most agricultural systems, tree-based land-use systems such as silvopasture that integrate trees in pasture production systems are likely to enhance soil carbon (C) sequestration in deeper zones of the soil profile. The total soil C at six depths (0 – 5, 5 – 15, 15 – 30, 30 – 50, 50 – 75, and 75 – 125cm) were determined in a silvopasture of slash pine (Pinus elliottii) + bahiagrass (Paspalum notatum), and on an adjacent treeless bahiagrass pastures at two sites, representative of Spodosols and Ultisols in Florida. The C contents within three fraction-size classes (250 – 2000, 53 – 250 and <53μm) of each soil profile were determined. Using stable C isotope signatures, the plant sources (C3 vs. C4 plant) of C fractions were determined and traced at both sites. Compared with the treeless pasture, the Spodosol profile between trees in a row in the silvopasture contained more C in the silt + clay fraction (<53μm) at and below the spodic horizon (~ 40cm deep). In both soil orders, the C3 plant (slash pine) contributed more C in the fraction <53μm than the C4 plant (bahiagrass) at all soil depths, particularly at the lower depth. The results support the hypothesis that under similar ecological settings, silvopastoral systems retain more stable C fraction in the soil profile than under treeless pasture.

(40) Experiences with Online Collaborative Software Adobe Connect - Distance Education M.S. Track in Environmental Science

B. Hoover, S. Grunwald

A large body of literature suggests that communication in the classroom is central to the learning process. Both on-campus and distance education (DE) students have social needs and interacting with others can improve learning outcomes. Recently, studies that investigated computer-mediated communication (CMC) and its relation to education have been emerging. Asynchronous and synchronous communication tools are diverse using text, video, audio and/or various additional tools (e.g. whiteboard, quizzes, file and desktop sharing) providing socially-oriented learning environments. They enhance active participation of students in courses and engage them in real-time discussions that stimulate critical thinking. The Adobe Connect (Breeze Live) online collaborative software (OCS) was introduced to support the DE Graduate Track in Environmental Science in 2005. We present the capabilities of Adobe Connect to support teaching and learning in a collaborative online environment. We analyzed the preferential usage of Adobe Connect OCS, barriers and teaching/learning experiences by surveying faculty and students.

(41) Calcium Phosphate Formation and Crystallinity as Influenced by Dairy Manure Components

M. Josan, V. Nair

Dairy manure applications to soils not only elevate phosphorus (P) concentrations, but also result in build-up of manure-derived components such as Mg, Ca, Si and dissolved organic carbon (DOC). Despite high pH and abundant Ca, stable forms of Ca and P such as apatite were not detected and high levels of P continue to be released from manure-amended soils. We evaluated the inhibitory effects of Mg, Si, and manure-derived DOC on Ca-P crystallization in the presence and absence of solids (clay-sized fractions) obtained from manure-amended soils. Solutions containing Mg, Si or DOC were prepared in a medium containing average concentrations of other major chemical species found in leachates of manure-amended soils. These solutions, including a control, were incubated with and without solids for 20 weeks. Median equilibrium concentrations of Ca and P after incubation were significantly less in solutions without solids, with the exception of the DOC-solution. Control and Si solutions had lower median P concentrations in the presence of solids than did the Mg-solution. Presence and absence of solids did not affect behavior of P in the DOC-solution; however, Ca concentrations declined, possibly due to organic complexation. Formation of hydroxyapatite in both control and Si solutions and the more soluble brushite in the Mg-solution was confirmed by x-ray diffraction. Apatite formation can be inhibited by Mg and/or DOC in dairy manure-amended soils, maintaining high P release. Mg-P in manure-amended soils would maintain P solubility, and Mg in soil solution would inhibit stable forms of Ca-P. Therefore, it is important to consider Mg in addition to Ca in explaining the fate of P in manure-amended soils.

(42) Enhanced Retention of Phosphorus Applied to Sandy Soils as Flushed Dairy Manure

A. Malek
Advisor: W. Harris

Leaching of phosphorus (P) is a major concern in many areas of the world, especially in environments with karst topography that contain sensitive and valuable aquifers and springs. In one such area, North Florida, dairy farming is prevalent, and in such operations it is common to spray crop fields with flushed dairy manure (FDM) as a means of nutrient recycling. Anaerobic digestion of FDM, currently practiced at the University of Florida Dairy Research Unit provides many benefits including reduction of organic matter (OM) and mineralization of nutrients, including P. We compared the leaching of P in three representative sandy soils amended with raw FDM, anaerobically-digested FDM, and an inorganic fertilizer. Amendments were applied at equivalent total P concentrations to soil columns in a randomized complete block design. Since OM is known to form complexes and compete for sorption sites with P, thereby reducing P sorption, we initially expected P retardation to be least in soils receiving P as raw FDM and most in soils receiving inorganic P. Soil columns were kept under 20 cm of suction to promote unsaturated flow and amendments were applied at one half of the soil pore volume. Leachate was collected per pore volume and analyzed colorimetrically for total P (TP) and dissolved reactive P (DRP). Little evidence of OM transport of P was found in columns receiving both raw and digested FDM, and through 30 pore volumes, very little leaching of P occurred. Soils receiving inorganic P retarded P movement the least, and the extent of retardation was related to the soils' inherent P sorbing capacity as related to Al and Fe oxide content. Significant differences in P accumulation in the soils among P amendments and soils were indicated by ANOVA, as well as a P amendment * soil interaction. Duncan's Multiple Range Test showed the P accumulated in soils receiving inorganic P to be significantly less than those receiving raw or digested FDM. Precipitation with Ca and Mg contained in the FDM, entrapment of particulate P, and immobility of OM due to soil chemical conditions that promote flocculation are the suspected explanations for the lack of P breakthrough in FDM amended columns. The common presumption that manure-derived P leaches more readily than P from inorganic fertilizers due to OM effects is not born out by this study. However, precipitated- and/or entrapped P from FDM would not likely have long-term stability in soils of the SE USA due to eventual decrease in pH that promotes dissolution of Ca-, Mg-P and to mineralization of particulate organic P.

(43) Development and Validation of a Soil Water Budget Model for Citrus Irrigation Scheduling

K. Morgan, J. Wu, H. Beck, S. Grunwald
Southwest Florida Research & Education Center

The sandy soils of central and southern Florida have low water and nutrient retention capacities. Excessive irrigation may greatly increase nutrients leaching thereby contribute to contamination of the under-lying aquifer. These systems can be managed in such a manner that the excessive downward drainage through the soil is minimized via use of improved irrigation management and/or scheduling strategies which are also critical to maximize both water and nutrient use efficiency. To aid citrus growers in water management decision making, a computer-based decision support system to facilitate more efficient use of water by making use of specific site characteristics and local weather data, was developed. The objective of developing the Citrus Water Management System (CWMS) was to provide citrus growers with 1) irrigation scheduling to optimize N uptake based on estimated soil water content and daily ET, 2) improved nutrient retention in the citrus root zone, 3) reduced citrus irrigation water use, 4) record keeping to determine compliance with irrigation and nitrogen BMPs, 5) determine current estimated soil water and N concentrations at selected soil depths and locations as indications of BMP validation, and 6) simulation of effect of irrigation and rainfall on future N application. The CWMS model was validated using data from a project collecting soil moisture data over a three year period from two separate citrus orchards. The two orchards were on deep sandy soils Entisols (Candler fine sand, typical of the production area of the region), the citrus tree scions were 'Valencia' and 'Hamlin' sweet orange greater than 10 years old. Soil moisture at 10, 20, 30, and 50 cm depths were recorded at 30 min intervals and irrigation, rainfall, and ET summarized daily from June 2004 to June 2007. The model was initialized using spacing and irrigation system information provided for each orchard. Midnight soil moisture values at each depth were compared with soil moisture estimates from the model at the same depths. Monthly root mean square error (RMSE) and model efficiency index (IA) were used to determine the relative accuracy of the model estimates and correlation of change in soil moisture values over time. RMSE and IA were 0.01 cm3 cm-3 and 0.71 representing relatively good agreement between estimated and measured soil moisture values. . Appropriate use of this system should not only reduce statewide agricultural water requirements but also N-loading of groundwater resources associated with citrus production thereby enhancing the profitability and sustainability of Florida citrus production systems.

(44) Effect of Frond Harvest Methods and Sources of Water Refill on Arsenic Phytoremediation Using *Pteris vittata. L* – Chinese Brake Fern

S. Natarajan, R. Stamps, U. Saha, L. Ma, D. Hernandez, Y. Cai

For the first time an industrial scale hydroponic system for phytoremediation of arsenic (As) contaminated groundwater using Pteris vittata (Chinese brake fern) was tested successfully in the field. In this study, a combination of two water refill sources [As-contaminated (140–180μg L-1) water or "clean" water (low As <7 μg L-1)] to compensate the evapotranspiration (ET) loss and three frond harvest methods (6" from rhizome, selective and no/infrequent harvest) were investigated. A long term study for 30 weeks with two cycles (Cycle 1 and 2) of water change by reusing the same fern was conducted. Results indicate that refilling tanks with "clean" water was more effective (140 to <10 μg L-1 in 8 weeks) compared to refilling with As-contaminated water (17 weeks) during Cycle-1. Reuse of same fern in Cycle-2 starting with 180 μg L-1 As, further reduced this duration by 2–5 weeks, indicating that well established ferns can remediate the water more rapidly. Considering the fern growth and its performance, frond harvesting while continuously loading the ferns with As-water was not a wise choice. A combination of As-water refill and no/infrequent-harvest may be recommended for a cost effective As-Phytoremediation. Selectively harvesting only the mature and senescing fronds and refilling with "clean" water was found to be the best practice.

(45) Surface Water Quality Evaluation Using Multiple Techniques

Y. Qian, K. Migliaccio, Y. Wan, Y. Li

Appropriate assessment of long-term water quality monitoring data is essential to evaluation of water quality and this often requires use of multiple techniques. Our objective was to evaluate water quality in the southern Indian River Lagoon (IRL), Florida, including i) providing a methodological example of trend analysis using water quality data with seasonality; ii) evaluating nutrient concentration trends and load variations using the Estimate TREND (ESTREND) and Load Estimator (LOADEST) programs; and iii) assessing "overall" water quality using several multivariate techniques and a comprehensive water quality index (WQI). These results revealed the seasonal pattern and seasonal trend of surface water quality constituents, the evolution of nutrient concentration and load during long-term period, as well as seasonal and spatial differences characterized by multivariate techniques. A composite WQI was developed based on principal water quality constituents greatly contributing to the construction of factors which were derived from EFA. This simple and scientific-based WQI showed significant difference among monitoring locations and between seasons. Long-term trends of WQI can indicate the "overall" water quality changes. The outcomes are meaningful for future management decision making and beneficial for this unique ecosystem.

(46) Effectiveness of Soil Amendments in Metal Stabilization in Florida Shooting Range Soils

U. Saha, A. Fayiga, L. Ma
Biogeochemistry of Trace Metals Laboratory

Pollution of lead (Pb), arsenic (As), and antimony (Sb) in shooting range soils is of environmental concern due to their adverse impacts on human and animals. This research is to develop a berm material that is effective in slowing down bullets weathering process, stabilizing Pb, Sb, and As and facilitating bullets removal. Eight amendment combinations were tested with 15% clay or phosphatic clay plus 5% of clay, lime, phosphate rock, Fe-WTR (water treatment residuals) or compost. Leachate and soil samples were collected bi-monthly and analyzed for total and water-soluble Pb, As and Sb. While phosphate rock and phosphatic clay were least effective, Fe-WTR and compost were the most effective in reducing leachable Pb, As and Sb. The results from this study would help to develop effective metal management practices in shooting range soils to minimize the adverse impacts of trace metals.

(47) Soil Carbon Sequestration

N. Comerford et al.

Soil Carbon Sequestration and Inventory is an ongoing research program within the Soil and Water Science Department. This poster gives an overview of programs and the people involved. More information will be available on an upcoming website currently being developed by the department.

(48) A New Tool for Environmental Risk Assessment on Sandy Soils: Safe "Soil Phosphorus Storage Capacity"

V. Nair, W. Harris

The capacity of a soil to retain phosphorus (P) relates to risk of P loss from sandy soils to adjacent water bodies. A new concept, the safe soil P storage capacity (SPSC), was developed to predict the "safe lifespan" of a soil under different intensities of P impact. This approach was based on a threshold P saturation ratio (PSR) of 0.15, calculated as:

PSR = where Ox = oxalate

The 0.15 PSR threshold was determined to be the best approximation to maintain the 0.10 mg L-1 critical P solution concentration in groundwater. SPSC is intended to go a step further than soil test P (STP) and PSR, which are often used in P runoff and leaching assessments, by providing a means to estimate how much P can safely be added at an application site. For example, low STP and PSR for the surface horizon of an unimpacted Okeechobee Spodosol would be a false indication of low risk because safe P storage capacity is minimal. The SPSC would indicate the true risk. The environmentally safe SPSC for dairy and poultry manure-amended sandy soils was validated by evaluation of SPSC response to P gain or loss under controlled laboratory conditions. The equation used in the calculation of SPSC is:

SPSC = (0.15 – PSR) x Ox(Fe + Al).

Illustration of the use of this recently-developed concept using field data include: i) SPSC under high and low dairy and poultry manure-impacted soils in the Suwannee River Basin; ii) preliminary implications for P release from Spodosols of the Lake Okeechobee Basin; and iii) less reduction in P storage capacity under silvopasture – the integration of trees, pasture and animals – than under an adjacent treeless pasture under similar management practices.

A negative SPSC indicates that the volume of soil assessed is already a P source (exceeding environmental thresholds of P in solution). If SPSC is positive, the amount of P that could be added before the soil becomes an environmental risk can be calculated. Using this scenario, P could be applied to the soil at an agronomic rate based on the normal IFAS recommendations unless the SPSC < 0, at which point no further P could be applied. Alternatively, depending on how much the SPSC is above zero, a recommendation to apply P only at crop recovery quantities could be made. Therefore, SPSC would be a more useful indicator of P loss risk than STP or PSR in P indexing schemes because it conveys remaining safe loading capacity as well as current risks arising from previous loading. Oxalate extraction is not frequently performed in soil test laboratories in Florida or in other parts of the U.S. causing practical difficulties in the measurement of parameters for PSR and SPSC calculations. On-going research aims at providing a calibration for SPSC calculations using common soil test parameters such as Mehlich 1- and Mehlich 3- P, Fe and Al. The use of these routine agronomic soil tests to calculate SPSC would provide a more accessible analytical tool for P management.

(49) Biochemical Composition of Extracellular Polymers Produced by Everglades Periphyton

B. Bellinger, M. Gretz, S. Hagerthey

Periphyton communities in the Florida Everglades represent a significant component of the overall primary production in this vast wetland ecosystem. Distinct communities have developed in response to local water quality conditions. In Water Conservation Area (WCA)-1 in the northern Everglades, desmid and diatom communities dominate this soft water impoundment, whereas in WCA-2A, immediately to the south of WCA-1, alkaline hard waters result in calcifying cyanobacterial and diatom periphyton communities. The cohesive nature of the periphyton assemblages is a result of the production of Extracellular Polymeric Substances (EPS) by the constituent algae within the matrix. EPS was operationally separated into two distinct fractions; a water soluble (WS) fraction, and an 0.1 M EDTA (EDTA) fraction. Fractions from algal assemblages within both areas were carbohydrate rich, and also contained significant amounts of uronic acid residues. Protein and sulfate content was generally low in all fractions. The WS fraction from all mats was generally dominated by glucose. EDTA-soluble EPS from periphyton in WCA-2A were rich in glucose, xylose, fucose, and galactose. Composition of EPS produced in the cyanobacterial mats is similar to EPS observed in calcified tufa mats of streams, from planktonic cyanobacteria responsible for whitening events in lakes, and to EPS found in marine stromatolites. EDTA-soluble EPS in periphyton from WCA-1 had reduced proportions of glucose and xylose, and a greater content of fucose and rhamnose. Ideal water chemistry combined with a EPS substrate enables precipitation of calcium carbonate by periphyton in specific portions of WCA-2A. However, phosphorus enrichment (northern WCA-2A), or low ion concentrations (WCA-1) inhibit calcification of periphyton mats. This work provides a first look at EPS produced by periphyton in the Florida Everglades, and combined with water chemistry, gives insight into the calcification process observed.

Interdisciplinary Teaching, Research, and Extension Programs in Soil and Water Science

Soil and water are among the most important of all natural resources. Maintaining soil and water quality is essential to sustainable agricultural productivity and the protection and conservation of natural resources. Our programs are focused to address soil and water quality issues in a wide range of ecoystems including: agricultural lands, forested lands, rangelands, urban lands, wetlands, shallow lakes and estuaries. The Soil and Water Science Department (SWSD) has established itself as a leader in teaching, research, and extension/outreach programs in management and restoration of these resources. Our programs carry global significance in the areas of water quality, ecosystem productivity, environmental services, carbon sequestration, greenhouse gases, and climate change.

To meet new challenges and explore new opportunities, the SWSD's research, teaching, and extension programs are focused in five thrust areas:

- Management of Nutrients, Pesticides, and Wastes
- Remediation of Contaminated Soils, Waters, and Aquifers
- Soil Quality and Ecological Indicators
- Soil-Landscape Analysis
- Wetlands and Aquatic Systems

Teaching Programs

Undergraduate Programs

- Soil and Water Science
- Environmental Management in Agriculture and Natural Resources *(Interdisciplinary degree)*

These tracks are designed to give the student a strong background in Soil and Water Sciences and prepare students either for pursuing graduate degree or for obtaining employment with state and federal agencies, consulting companies, and industry.

Graduate Programs

- Soil and Water Science
  - Soil Science Track
  - Environmental Science Track
- Hydrologic Science concentration
- Wetland Science concentration
- Ecology *(Interdisciplinary graduate degree)*

Graduate programs in Soil and Water Science are designed for students seeking careers in soil, water, and environmental sciences related to agriculture and natural resource management. To meet specific needs, Master of Science students and Doctor of Philosophy students enrolled in the SWSD may develop their graduate programs in one of the tracks, with their research project in one or more of the department's thrust areas.

Distance Education Graduate Program

The SWSD offers a Master of Science degree (professional or thesis option) with Environmental Science track via distance education to accommodate students interested in environmental issues related to the soil and water quality of: agricultural lands, forested lands, range lands, urban lands, or wetlands. The program is open to all prospective students, and specially designed for place-bound students, who are currently employed full-time by state and federal agencies or private industry.

Research Programs

The interdisciplinary nature of SWSD programs provides students and faculty an opportunity to conduct basic and applied research at multiple (molecular to landscape) scales to solve environmental problems and protect and manage land

Interdisciplinary Teaching, Research, and Extension Programs in Soil and Water Science, *continued*

and water resources. The SWSD programs are designed to meet the changing needs of our clientele at state, national and international levels, by focusing especially on the following thrust areas:

Management of Nutrients, Pesticides, and Wastes, with emphasis on soil-water-plant relationships, rhizosphere processes, fate and transport of nutrients, pesticides, and trace metals, management of animal wastes, biosolids, compost, and other non-hazardous wastes, and water quality.

Remediation of Contaminated Soils, Waters, and Aquifers, with emphasis on fate and transport of toxic organics and metals, and in situ immobilization of metals, bioremediation, molecular microbial ecology, and groundwater quality

Soil Quality and Ecological Indicators, with emphasis in soil morphological indicators, chemical contributors and indicators, microbial contributors and indicators, and ecosystem restoration

Soil-Landscape Analysis, with emphasis in soil genesis and classification, pedologic processes, landscape hydrology, soil and water chemical processes, soil and water microbial processes, and risk assessment

Wetlands and Aquatic Systems, with emphasis on biogeochemistry, soil-water–plant relationships, hydrology, hydric soils, ecological indicators, treatment wetlands, restoration of lakes, and water quality.

Extension/Outreach Programs

The SWSD extension faculty translate current, relevant soil and water science knowledge into user-friendly formats for Florida residents, visitors, industry, business, governmental agencies, and county agents. Format includes publications, presentations, in-service training, videos and computer software. These emphasize the SWSD's five thrust areas and 10 of the Florida cooperative Extension Service's State Major Programs (SMPs). SMPs cover precision agriculture, crop production and management, sustainable development and environmental regulations, and water quality. The SWSD faculty's basic and applied research supports extension efforts by addressing current and anticipated land, soil, and water resource uses and potential environmental problems.

For more information on our programs, research, faculty, and students, please visit our website at http://soils.ifas.ufl.edu/ or contact us at (352) 392.1803 or soils@ufl.edu.

MANAGEMENT OF NUTRIENTS, PESTICIDES, & WASTES

The Soil and Water Science Department (SWSD) at the University of Florida conducts teaching, research, and extension in Management of Nutrients, Pesticides, and Wastes, with emphasis on soil-water-plant relationships, rhizosphere processes, fate and transport of nutrients, pesticides, and trace metals, management of animal wastes, biosolids, compost and other non-hazardous wastes, and water quality.

This thrust area addresses nutrient and pesticide management in agricultural, forested and urban ecosystems in order to maximize nutrient uptake and pesticide efficacy and to achieve optimal crop yield/quality, while minimizing losses by surface runoff or leaching in an effort to protect surface and ground water quality. Specific topical areas include sorption, desorption, and transformations of agrichemicals, their transport with surface and ground water, and microbial contributions to plant productivity with emphasis on rhizosphere effects. This program also addresses the effects of land application of industrial by-products and other waste materials such as compost, animal wastes, municipal biosolids and effluents, paper mill ash and sludge, and food processing wastes as sources of nutrients for plants and the potential risks of accumulation of toxic elements in the soil, crops, and water resources.

FACULTY

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Don Graetz
Jim Graham
Ed Hanlon
Zhenli He
Yuncong Li
Cheryl Mackowiak
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Ann Wilkie
Amy Shober
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Tom Obreza
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Li-Tse Ou
Jack Rechcigl
Jerry Sartain
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Amy Shober
Craig Stanley
Chris Wilson
Ed Dunne
Patrick Inglett
Maria Silveira
Max Teplitski
Gurpal Toor

PROGRAM AREAS

Soil-water-plant relationships
Rhizosphere processes
Fate and transport
Nutrients
Pesticides
Trace metals
Waste management
Animal wastes
Biosolids
Compost
Other non-hazardous wastes
Turfgrass fertility management
Groundwater quality

REMEDIATION OF CONTAMINATED SOILS, WATERS, & AQUIFERS

The Soil and Water Science Department (SWSD) at the University of Florida offers excellent interdisciplinary research and educational opportunities for students seeking specialization in Remediation of Contaminated Soils, Waters, and Aquifers, with research emphasis on fate and transport of toxic organics and metals, in situ immobilization of metals, bioremediation, molecular microbial ecology, and groundwater quality

The major focus of this program is on characterization and quantification of various physical, chemical, and biological processes that determine the behavior of organic and inorganic contaminants in soils, sediments, surface waters and aquifers. The relevant processes and the inter-relationships among them are studied over a wide range of spatial (varying from molecular to field scale) and temporal scales (varying from seconds to years). The long-term goals of this thrust area are to develop an understanding based on experimental and theoretical investigations, and to develop (1) predictions of system behavior; (2) management and remediation technologies; and (3) educational tools. Findings would be applicable to a wide variety of sites (e.g., gas stations, dry cleaning shops, chemical spills, industrial waste sites).

PROGRAM AREAS

Fate and transport of toxic organics and metals
In situ metal immobilization
Bioremediation/phytoremediation
Molecular microbial ecology
Groundwater quality

FACULTY

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George O'Connor
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Li-Tse Ou
R. Dean Rhue
Chris Wilson
Patrick Inglett
Ann Wilkie
Gurpal Toor

SOIL QUALITY AND ECOLOGICAL INDICATORS

The Soil and Water Science Department (SWSD) at the University of Florida offers excellent interdisciplinary research and educational opportunities for students seeking specialization in Soil Quality and Ecological Indicators, with research emphasis in soil morphological indicators, chemical contributors and indicators, microbial contributors and indicators, and ecosystem restoration.

Soil quality is defined as the continued capacity of a soil to function as a vital living system in order to sustain biological productivity, maintain the quality of the environment, and promote plant, animal, and human health. Development and evaluation of quantitative indicators of soil quality and environmental integrity are needed for a variety of applications, including maintenance of a healthy rhizosphere ecology, establishment of endpoints for remediation of contaminated sites, assessment of anthropogenic impacts such as nutrient loading on terrestrial, wetland, and aquatic ecosystems, and evaluation of ecological effects of land management practices.

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Patrick Inglett
Todd Osborne
Max Teplitski
Alan Wright

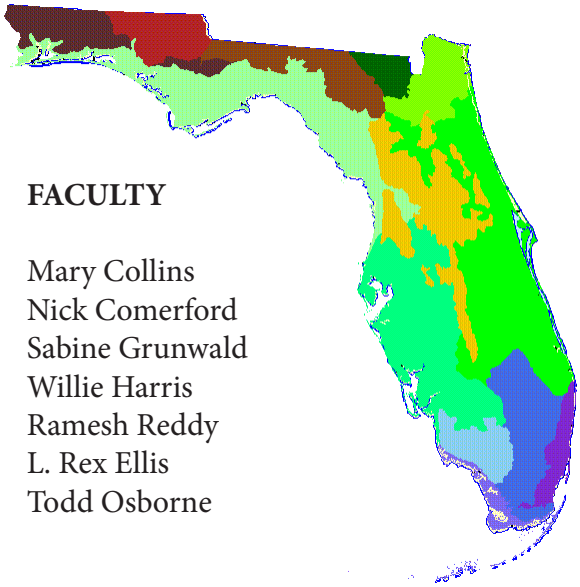
PROGRAM AREAS

Soil morphological indicators
Chemical contributors and indicators
Microbial contributors and indicators
Ecosystem restoration

SOIL-LANDSCAPE ANALYSIS

The Soil and Water Science Department (SWSD) at the University of Florida offers excellent interdisciplinary research and educational opportunities for students seeking specialization in Soil-Landscape Analysis, with research emphasis in soil genesis and classification, pedologic processes, landscape hydrology, soil and water chemical processes, soil and water microbial processes, and risk assessment

Many human activities have environmental consequences that relate to soils as natural bodies on the landscape. For example, soil properties and distributions strongly influence the environmental fate of nutrients, pesticides, and other potential contaminants. The goals of this thrust area are to (1) improve the understanding of Florida soils as natural bodies within landscape/hydrological continua, and (2) develop techniques for landscape-scale modeling and risk assessment that can be applied to both rural and urban settings. The first goal encompasses fundamental pedological research at spatial and temporal scales appropriate for the processes studied. The second goal entails an integration of hydrological pedological, ecological, and biogeochemical properties. This program also involves the maintenance of expertise in geographic applications (e.g., GIS geostatistics and modeling), and a departmental commitment to multidisciplinary research at environmentally relevant scales.



FACULTY

Mary Collins
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Sabine Grunwald
Willie Harris
Ramesh Reddy
L. Rex Ellis
Todd Osborne

PROGRAM AREAS

Soil genesis and classification
Landscape hydrology
Soil and water chemical processes
Soil and water microbial processes
Risk assessment

WETLANDS AND AQUATIC SYSTEMS

The Soil and Water Science Department (SWSD) at the University of Florida offers excellent interdisciplinary research and educational opportunities for students seeking specialization in Wetlands and Aquatic Systems, with research emphasis on biogeochemistry, ecology, hydrology, hydric soils, ecological indicators, treatment wetlands, and water quality.

The interdisciplinary nature of the program provides graduate students an opportunity to conduct basic and applied research at multiple (molecular to landscape) scales in order to solve environmental problems and protect and manage wetlands and aquatic resources. Long-term goals of this thrust area are: (1) evaluate biogeochemical indicators for routine use to evaluate pollutant impacts on wetlands and aquatic systems; (2) develop tools to extrapolate process-level to a wide range of spatial and temporal scales for use in restoration and management of wetlands and aquatic systems; (3) develop a GIS database of soil and sediment characterization in Florida wetlands and associated aquatic ecosystems; (4) provide process-level information for use in policy development and regulation, and (5) promote interdisciplinary teaching, research and extension programs, including systems ecology, limnology and hydrology. Some examples of wetlands and aquatic ecosystems currently used in research are: the Everglades, Lake Okeechobee, Upper St. Johns River Basin, Indian River Lagoon estuary, Florida Bay, and several constructed wetlands throughout the State of Florida.

FACULTY

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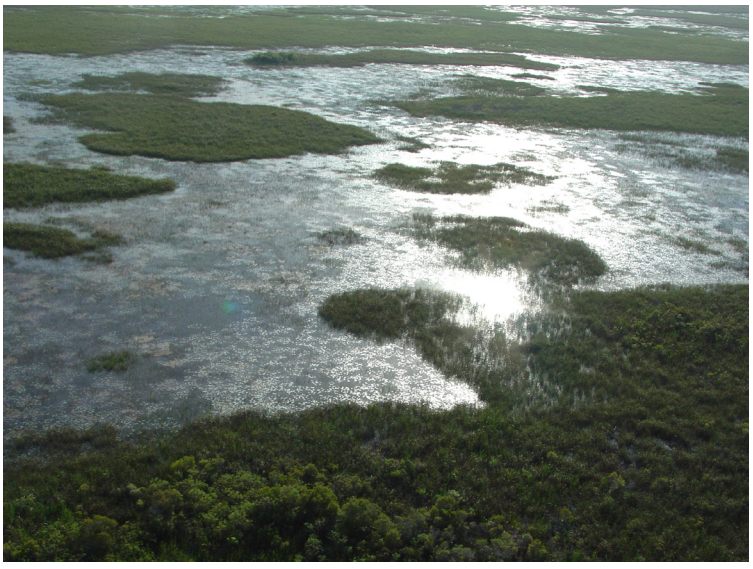
PROGRAM AREAS

Hydric soils
Wetland delineation
Hydrology
Soil-water-plant relationship
Molecular microbial ecology
Biogeochemistry
Restoration of wetlands and lakes
Water quality



Plan to Attend

9th Annual Soil & Water Science Research Forum

September 12th 2008
J. W. Reitz Union
University of Florida - IFAS
Gainesville, Florida

10th Annual Soil & Water Science Research Forum

September 11th 2009
J. W. Reitz Union
University of Florida - IFAS
Gainesville, Florida