A Soil and Water Science Department Publication

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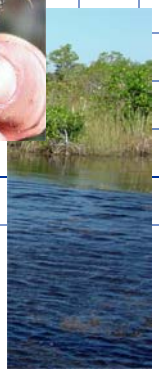

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Pictures of Lake Okeechobee-courtesy of the South Florida Water Management District

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From the Chair

Lake Okeechobee Watershed in Focus

In this newsletter we highlight the Soil and Water Science Department's (SWSD) research and outreach activities in the Lake Okeechobee Watershed. Lake Okeechobee is a shallow lake (average depth of 2.7 m) located in south central Florida, and covers a surface area of 1730 km^2. The watershed of the Lake includes areas south of Orlando to areas that border the lake on the south, east, and west, with an estimated area of 1.6 million hectares. Lake Okeechobee has been defined by the United States Environmental Protection Agency as an impaired waterway and new legislation will require large reductions in phosphorus loads to meet a new lower Total Maximum Daily Load (TMDL) to the lake. A TMDL is a target for the total annual amount of a given nutrient that can enter a particular water body to meet established goals for maintaining or improving water quality. The current TMDL for total phosphorus additions to Lake Okeechobee has been set at 140 metric tons per year with a long-term goal of achieving a water column phosphorus concentration of 40 parts per billion by the year 2015, as specified by the Lake Okeechobee Protection Act (Chapter 0030, Laws of Florida), which was passed by the Florida Legislature to establish a restoration and protection program of the lake.

Our current research and outreach activities as a part of IFAS initiative are funded by state agencies including Florida Department of Environmental Protection (FLDEP), Florida Department of Agriculture and Consumer Services(FLDACS), and the South Florida Water Management District (SFWMD). This interdisciplinary activity is conducted in collaboration with several IFAS/UF units including: Agricultural and Biological Engineering, Environmental Engineering Sciences, Food Resource and Economics, Gulf Coast REC, Southwest Florida REC, Everglades REC, and the Okeechobee County Extension Office.

In addition, some of our projects are also conducted in collaboration with the Archbold Biological Station, and the DB Environmental Labs, inc. Our research in this watershed includes: determining (1) strategies to immobilize excess soil phosphorus and evaluate BMPs, (2) nutrient management strategies for cropping systems in the watershed, (3) the role of isolated and constructed wetlands in phosphorus retention, and (4) the internal phosphorus flux from sediments to the water column in shallow lakes in the watershed including Lake Okeechobee.

Current research and extension activities are our continued commitment to address soil and water quality issues in this watershed. During late 1980's we conducted two major research projects (funded by the SFWMD) address the phosphorus issues in the watershed and the lake, and since that time we have maintained a modest presence in this area.

Results of this early research (summarized as special issue in Ecological Engineering 1995, volume: 5) were used by state agencies to formulate regulation and management strategies. This early work provided impetus for our current research and extension activities in the watershed. A few examples of current projects are presented in this newsletter.

The SWSD had a productive 2003 year. Our graduate enrollment is improving with 70 students on campus and 17 students in the distance education program. We are making concerted effort to improve our undergraduate program. With the addition of new courses enrollment in our classes is steadily increasing. Our grant expenditure by Gainesville faculty for 2003 exceeded $3 million. Approximately 37% funding is from non-federal, 8% from industry, 12% from special federal grants, and 43% federal agencies. Our extension programs are making a significant impact around the state in addressing soil and water quality issues. In 2004, we plan to stay on course as we meet new challenges and explore new opportunities.

KRReddy

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SOIL AND WATER SCIENCE SHORT COURSES

Hydric Soils (W. Hurt). This exclusive training program focuses on the interrelations of hydrology and hydric soils and how to distinguish hydric soils from nonhydric soils. Three sessions are offered: March 9-11, 2004; May 4-6, 2004; and September 14-16, 2004. Wade Hurt (wade_hurt@ifas.ufl.edu).

GIS Applications in Soil and Water Science: (S. Grunwald). This exclusive training program focuses on how to make use of readily available geo-data layers of soils, geology, land use, and topography. July 28-29, 2004. Sabine Grunwald (SGrunwald@ifas.ufl.edu).

GRADUATED STUDENTS FALL 2003

Daniel Herrera, MS, Advisor, R. Mylavarapu
Mark Lander, MS, Advisor, M. Collins,
Sue Simon, MS, Advisor, J. White
Ronald Corstanje, PhD, Advisor, K. Reddy
Shinjiro Sato, PhD, Advisor, N. Comerford

NEW STUDENTS FALL 2003

Shannon Curtis, MS, Advisor, J. White
Miguel Mozdzen, MS, Advisor, C. Wilson
Attanu Mukherjee, MS, Advisor, V. Nair
Jeanne Ragsdale, MS, Advisor, Y. Li
Caroline Reis, MS, Advisor, J. Sartain
TJ Rew, MS, Advisor, D. Graetz
Casey Schmidt, MS, Advisor, M. Clark
Jeffrey Smith, MS, Advisor, M. Clark
David Stuckey, MS, Advisor, M. Clark

Sampson Agyin-Birikorang, PhD, Advisor, G. O'Connor
Kimberly Epps, PhD, Advisor, N. Comerford
Min Liu, PhD, Advisor, J. Sartain
Olawale Oladeji, PhD, Advisor, G. O'Connor
Daniel Perkins, PhD, Advisor, J. Jawitz
Thomas Saunders, PhD, Advisor, M. Collins

2003 E. T. YORK LECTURER

Dr. Pedro A. Sanchez, the 2002 World Food Prize laureate, Director of Tropical Agriculture and Senior Research Scholar at the Earth Institute of Columbia University in New York City, and a McCarther Fellow, delivered E.T. York Lecture entitled " *Ending hunger in Africa: What needs to done*". The lecture was attended by 500 people including faculty and students.

During his visit to UF, Dr. Sanchez visited with several faculty and students various UF units including: Agronomy, Agricultural and Biological Engineering, Forestry, and Soil and Water Science. Dr. Sanchez was hosted by Agronomy Department, School of Forest Resources and Conservation, and SWSD.

Please plan to attend the 5th Annual SWSD Research Forum on September 2, 2004
Details will be posted in the next newsletter and the SWS website

FACULTY, STAFF AND STUDENTS

Awards

The following have been recognized for their accomplishments. Congratulations!

Polston Scholarship – Arne Olsen and Dara Park

Robertson Scholarship – Kelly Morgan

F.B. Smith Scholarship – Leanna Totten

SWSD Award for Excellence in Graduate Studies – PhD level – Hector Castro and Ron Corstanje

SWSD Award for Excellence in Graduate Studies – MS level – Michael Tischler

SWSD Superior Accomplishment Award – Abid Al-Agely

Lena Ma was elected as a Fellow of the Soil Science Society of America

Mary Collins is selected to be the nominee for the 2004 President of Soil Science Society of America

Nick Comerford is selected as Board Member for S-7 Division (Forest Soils) of the Soil Science Society of America

Willie Harris received the 2003 SWSD Teacher/ Advisor of the year award

New Soil and Water Science Faculty Member at North Florida REC, Quincy, FL
Cheryl L. Mackowiak

Dr. Mackowiak was born and raised in the Chicago area. She received her BS (1984) and MS (1990) degrees from Southern Illinois University-Carbondale in the Plant and Soil Sciences Department From 1985 to 1997 she conducted research in bioregenerative life support systems for a NASA contractor at the Kennedy Space Center. She was responsible for developing the horticultural practices and nutritional requirements of agronomic crops in hydroponic systems for long duration space travel and space habitats. Her research shifted from horticulture to rhizosphere chemistry as nutrient recycling strategies from crop residues and human waste products were being developed. In 1997, Dr. Mackowiak attended Utah State University, where she received her PhD in plant nutrition and soil fertility in 2001. In 2002 to 2003 she was employed by the USDA Forest Service at the Rocky Mountain Research Station, Logan Utah, as a postdoctoral soil scientist to develop strategies for remediating public lands (rangeland and wetlands) contaminated by selenium and other trace elements originating from phosphate mining operations in southeast Idaho. In 2004, Dr. Mackowiak accepted a faculty position with the NFREC in Quincy to assume the duties of research and extension in nutrient BMP development for agricultural lands. Contact information: clmakcowiak@ifas.ufl.edu.

RESEARCH PROGRAMS IN THE OKEECHOBEE WATERSHED

THE IMPORTANCE OF POTASSIUM IN FLORIDA CITRUS NUTRITION

Soils used for Florida citrus production are typically dominated by quartz sand, with very little clay and organic matter. These soils are extremely low in natural fertility and water-holding capacity. Managing water and nutrients efficiently on these soils is a challenging task for citrus production managers. Typically, the nitrogen (N) fertilizer rate applied to mature citrus ranges between 150 and 250 lbs/acre. Potassium (K_2O) is usually applied at 1.0 to 1.25 times the N rate. While the inefficiency of N fertilizer is well known, K is usually thought of as an immobile nutrient in most parts of the world. However, Florida sands have only a small capacity to hold K against leaching as evidenced by repeated soil testing. Potassium is important in fruit formation and enhances size, flavor, and color. A shortage of K can result in lost crop yield and quality. In 1998, funding from the Florida Citrus Producers Research Advisory Council and the Foundation for Agronomic Research helped us initiate a K fertilizer experiment in a young southwest Florida grapefruit grove, to evaluate the effect of K fertilization on yield and fresh fruit quality, and to develop recommendations that will produce qualities most desired by fresh fruit consumers. Our data suggest that maximum tree size and yield will occur when fertilizer is applied yearly at 200 to 250 lbs K_2O/acre. Visually, trees that received the 200 lbs/acre rate had an expanded, branching canopy compared with a tight, bushy appearance of trees that did not receive K. Fruit size and peel thickness increased with increasing K fertilizer rate, but brix was maximized at about 200 to 250 lbs K_2O/acre. Growers must consider all factors and strike a balance between them when deciding on the rate of K fertilizer to apply. For additional information, contact Tom Obreza at taob@ifas.ufl.edu.

4-year-old grapefruit tree grown on a flatwoods soil with sufficient N fertilizer but no K fertilizer. (Notice tight, compact tree with no visible fruit)

4-year-old grapefruit tree grown on a flatwoods soil with sufficient N fertilizer and 200 lbs K_2O per acre per year. (Notice more branching, expansive tree canopy with visible grapefruits)

NUTRIENT LOADS IN SURFACE RUNOFF FROM CATTLE RANCHES IN SOUTH FLORIDA

Beef cattle ranching is the major land use in the watershed north of Lake Okeechobee. An interdisciplinary project was initiated at the MacArthur Agro-ecology Research Center (MAERC) in 1998 to examine the influence of cattle stocking density and pasture type on nutrient loads in surface runoff, with the goal of developing recommendations for Best Management Practices (BMPs) to improve water quality on beef cattle ranches in the region. This project received major support from state agencies (SFWMD, FLDACS, and FLDEP), as well as the USDA and Florida Cattleman's Association. Patrick Bohlen (Archbold Biological Station and courtesy faculty in SWSD), Ken Campbell (Ag. & Bio. Eng. UF/IFAS), John Capece (Southern Datastream) and Don Graetz (SWS UF/IFAS) led the water quality components of this project. Replicated experimental pastures were stocked at four animal densities (control, low, medium and high) and cattle were rotated seasonally between improved summer pastures (20 ha) and semi-improved winter pastures (32 ha). The experimental treatments were maintained for 5 years and were discontinued in fall 2003. Results show no significant effects of cattle stocking density on any nutrient parameter measured. However, concentrations of total phosphorus, the major nutrient of concern, are nearly 5 times greater, and total loads 7 times greater from improved than from semi-improved pastures. The greater loads from improved pastures are apparently linked to historical phosphorus fertilizer application. Phosphorus fertilizer was applied regularly to the improved pastures for at least 15-20 years prior to 1987, at which time its use was discontinued. Don Graetz and Patrick Bohlen are continuing to analyze the data from the pastures to link soil phosphorus characteristics with phosphorus loads in surface runoff. For additional information contact Patrick Bohlen at pbohlen@archbold-station.org.

Flume in the experimental watershed

CHEMICAL AMENDMENTS FOR SOIL PHOSPHORUS REMEDIATION

Rainfall Simulator

Addition of chemical amendments is seen as one of the options to increase phosphorus retention and reduce edge-of-field losses in the Okeechobee Drainage Basin. Amendments tested include water treatment residuals (iron, aluminum, and calcium-based), industrial by-products produced or marketed in Florida, and agricultural amendments (lime and gypsum). The suite of experimental approaches included lab equilibrations of soil + amendment suspensions to study P solubility reductions, small column studies to quantify phosphorus leaching, and simulated rainfall studies to measure runoff phosphorus. A wide range of amendments and rates were used in the lab study, which led to fewer amendments and rates for use in the leaching study. The list of materials and rates was further reduced in the runoff studies. The combined results from all studies identified an Aluminum water treatment residual (Al-WTR) from Manatee County as the material most appropriate for field testing. Performance of amendments in the field will be monitored (water quality leaving the fields and pasture grass response) for two years. Soil sampling before and with time after amendment addition will identify changes in soil-phosphorus solubility and form. This project is funded by FLDEP, FLDACS, and SFWMD. For additional information, contact George O'Connor at gao@ifas.ufl.edu.

INTERNAL PHOSPHORUS LOAD IN SHALLOW LAKES

Reducing nutrient inputs from nonpoint and point sources of pollution are essential to restoring lake water quality. However, even after external P load to lakes have been curtailed, internal phosphorus flux from the sediment to the water column can occur, contributing heavily to the degradation of water quality in lakes. The idea of internal loading is based on the recycling of nutrients from bottom sediments in lakes to the overlying water column. After load reduction, the internal load of sediments will determine the trophic status of a lake and the amount of lag time for recovery. Lakes Tohopekaliga (9,840 ha), Cypress (2,200 ha), Hatchineha (7,160 ha), Kissimmee (17,900 ha) and Istokpoga (11,200 ha) are shallow, eutrophic lakes located in the Upper Kissimmee River Basin. The surface water pH ranges from 6-8, and secci depth ranges from 0.6-1.2 m for all lakes. The entire Kissimmee River Basin (KRB) comprises 3,013 square miles; however, the upper basin covers 1600 square miles (USACE 1996). Phosphorus loads exiting these lakes and entering downstream Lake Okeechobee have doubled over the past 10 years. Consequently, we are determining the relative contribution of the sediments in each of these lakes to the overall nutrient export.

Chakesha Martin, graduate student sampling in one of the lakes

The equilibrium phosphorus concentration (EPC) can be used to determine whether the internal load will be a problem during restoration of a lake after load reduction. The EPC is defined as the phosphorus in solution that is in equilibrium with P in the solid phase or the point where phosphorus is neither being retained nor released from the sediment to the water column. At water column phosphorus concentrations above the EPC, phosphorus is retained by the sediments and at concentrations below, the sediments serve as a phosphorus source. The EPC can be a useful tool for water managers to determine which sediments may act as a potential source of phosphorus to the overlying water column of a lake. Water managers may consider dredging a lake as part of restoration; however, dredging is very cost-intensive; so it is important to look at the EPC of a lake to determine if it should be dredged for reduction of the export of nutrients to downstream Lake Okeechobee. For additional information contact John White at jrwh@ifas.ufl.edu.

EXTENSION

ISOLATED WETLANDS IN THE LAKE OKEECHOBEE WATERSHED

Wetlands are a prominent feature in the Lake Okeechobee watershed and account for approximately 18% of the land area or just over 21,000 hectares within the four priority basins Isolated wetlands account for slightly less than half of the total wetlands covering 8,800 hectares or 7% of the land area. Many of these isolated wetlands have been ditched and drained overtime to move water off the landscape and improve pasture conditions for cattle production. However, enhanced dewatering of the landscape can mean less time for biological and chemical assimilation of contaminants, and the potential that nutrients associated with animal wastes and fertilizer is released to surface or groundwater where they can have undesirable consequences. Cattlemen have been proactive in addressing water quality concerns by adopting a BMP manual for Water Quality and have been offered a presumption of compliance by implementation of recommended BMPs. One of these BMPs is to restore or enhance degraded wetlands on pastureland through the various easement and cost-share programs available to private landowners. Restoration and integration of wetlands will reduce the total surface runoff from the watershed and provide a longer detention time for nutrient assimilation by natural processes.

UF/IFAS Extension recently received an award from the USDA Cooperative State Research, Education and Extension Service to develop a program to educate landowners about the attributes of the different wetland enhancement or restoration programs. This extension program will educate landowners about the different wetland enhancement cost-share programs available and will also conduct training programs for Technical Service Providers, certified by USDA-NRCS, to assist landowners with their Conservation Plans. This project will include the development of various decision-making tools to support educational activities for landowners and technical service providers and will encourage landowners to participate in educational activities, additional training and participation in one or more wetland enhancement activities or programs. This program is expected to begin early in 2004. Mitch Flinchum, Mark Clark, and Pat Hogue are actively involved in this program. For additional information contact Mark Clark at clarkmw@ifas.ufl.edu.

Visit our new web site on wetlands extension: http://wetlandextension.ifas.ufl.edu/

INTERNATIONAL SYMPOSIUM ON NUTRIENT MANAGEMENT IN AGRICULTURAL WATERSHEDS: A WETLANDS SOLUTION

The SWSD-IFAS and Teagasc Research Center, Johnstown Castle, Co. Wexford, Rep. of Ireland are jointly hosting an international symposium on **Nutrient Management in Agricultural Watersheds: A Wetlands Solution,** scheduled for May 24-26, 2004, in Wexford, Ireland. The symposium will provide a forum for synthesis and interpretation of current status on the role of wetlands to improve water quality in agricultural catchments. It recognizes the interdisciplinary nature of the topic, the diversity of researchers from scientific and engineering disciplines, need to synthesize research information on current understanding of wetlands, need to transfer basic research information to managers involved in solving applied problems and to identify future directions for design and management of treatment wetlands. For additional information contact Ramesh Reddy at krr@ufl.edu.

SWS Alumni—We are in the process of updating contact information. Please visit our website at http://soils.ifas.ufl.edu/department/alumni.html and update your contact information. If you do not have access to a website, you can send us the updated information. In our future newsletter, we would like to include alumni news. So please send us information that you would like to share with your friends and colleagues.