Assessment of Management Impact on Soil Carbon Dynamics in Subtropical Grasslands.

Julius B. Adewopo[1] (Ph.D Candidate, UF, SWS Dept.), Maria L. Silveira (Associate Professor, UF, SWS Dept.), Stefan Gerber (Assistant Professor, UF, SWS Dept.)

[1]Corresponding author. Email address: adewopo@ufl.edu

Abstract:

Grasslands are indispensable for livestock productivity and profitability, and they serve critical ecological functions. However, most of the grassland ecosystem C (~90%) is allocated to below-ground reserves, and population-driven intensification can significantly alter soil C dynamics, hamper grassland's ability to carry the livestock population that they support, and severely erode its ecological functionality. This ongoing research is being conducted on established (>20 years) experimental sites at the UF-IFAS Range Cattle REC, Ona, Florida to quantify the long-term impacts of 3 levels of management intensity (intensively managed improved pasture, silvopasture, and native rangelands) on soil C stocks, allocation of below- and above-ground biomass, and soil C losses through CO_2 efflux. Using a comparative-mensurative experimental design, 150 sample soil cores were collected from six collocated ~6ha fields (2 replicate per site) at 3 soil depth increments (0 to 10, 10 to 20, and 20 to 30cm). Analysis for total carbon (TC) showed that improved pasture sequestered significantly higher TC at 0-10cm and 10-20cm depths (204 Mg ha^{-1}, $P = 0.044$ and 123 Mg ha^{-1}, $P = 0.005$ respectively), compared to silvopasture (199Mg ha^{-1} and 122 Mg ha-1) and native rangeland (161 Mg ha^{-1} and 71Mg ha^{-1}). At 20-30cm depth, silvopasture tended to have higher but non-significant TC (103 Mg ha^{-1}, $P = 0.185$) compared to improved pasture (86 Mg ha^{-1}) and native rangeland (57 Mg ha^{-1}). Outcomes of this study are expected to have important implications for management and policy-making decisions, in favor of balancing increased productivity with sustainability in grasslands ecosystems.

Abbrevation: C - Carbon

Water Quality Monitoring at Model Watershed Nagulapally-Konapur, Medak District, Andhra Pradesh, India

Cassandra Admire
Dr. Rao Mylavarapu
Dr. Kanwar Sahrawat

Abstract.

Water is the basis for survival and also one of the most threatened natural resource on our planet. In the future every country will be facing water quantity and quality issues, not just the developing countries. Africa and Asia already struggle with water scarcity and pollution. Water available for drinking and irrigating also may not be safe. These rainfed regions are completely dependent on monsoonal rains to irrigate their crops during growing season. Rainfed regions of the world are overwhelmed by poverty, malnutrition, water scarcity and severe land degradation. Areas such as these are chosen to have model watersheds implemented in the region and also serve as a station for institutes, such as the International Crops Research Institute for the Semi-Arid Tropics, to teach the local people located in the watershed better farming and water harvesting practices. Model watersheds, like Nagulapally, make it possible for small farmers to survive and make a better life for their families. This project involved taking water samples from open wells in the watershed that are used for irrigation and on some occasions, drinking water by humans and livestock, for monitoring the quality for the respective purposes. The samples were analyzed for irrigation parameters which include pH, electrical conductivity (EC), Ca, Na, K, Mg, S, B, Zn, Mo, Pb, As, Se, Cd, Hg, chlorides, nitrates, carbonates and bicarbonates. The water analyses showed that the water in the open wells was safe for irrigation. The electrical conductivity (EC) and percent sodium was in the Good to Medium irrigation water quality class, which however, in the long run may potentially result in degradation of soil quality and decreased crop yields. The water samples were not tested for any kinds of bacteria, but the test results did meet the standards for drinking waters

Relations of Iron, Aluminum, and Carbon along Transitions From Udults to Aquods

C. Banik, W.G. Harris, S. Balboa, L.R. Ellis, and G.W. Hurt

Soil and Water Science Department, Institute of Food and Agricultural Sciences,
University of Florida, Gainesville, FL 32611

Abstract

Depth and morphological expression of Bh horizons were studied with respect to iron (Fe), aluminum (Al) & carbon (C) concentrations along four transects encompassing transitions from poorly-drained Aquods to better drained soils. The Bh horizons of Aquods were well-expressed, but Bh horizons along the transition toward better –drained soils became shallower and less-well expressed, ultimately fading into the surface horizon. Organically-complexed and amorphous Fe and Al were extracted by pyrophosphate and ammonium oxalate, respectively, and measured by inductively coupled plasma spectrometry. Pyrophosphate-extractable C and total C were measured by flash combustion. Extractable Al in Bh horizons correlated positively with extractable- and total C as well as with measures of Bh expression and depth to upper boundary. However, extractable Fe correlated negatively with these variables. Weak Bh horizons of better-drained soils had higher Fe concentrations and Fe/Al ratios than did more strongly expressed Bh horizons of poorly-drained soils. Results suggest that pedogenic processes fostering Bh formation in Aquods are hindered by the presence of Fe in the grain coatings of better drained soils.

Bioremediation of DDE, DDD, and DDT in Sandy Soil from Site ZSS3027 in Field ZSE-J in the Lake Apopka North Shore Restoration Area

John Thomas
Soil and Water Science Department
University of Florida
Telephone: 352-392-1951
Email: thomas@ufl.edu

Ben Coppenger
Soil and Water Science Department
University of Florida
Adviser: Dr. John Thomas
Email: bjc22388@ufl.edu

Abstract: DDT is an organochlorine pesticide (OCP) that was almost completely banned in the United States in the 1970s due to the public negative attention given to DDT after the book *Silent Spring* questioned the usage of DDT. It is still used, however, for disease vector control with malaria-carrying mosquitos. Due to its insolubility in water and its tendency to bond strongly with soil organic matter, it still persists in soils today. The main purpose of this research is to test the feasibility of adding beer wort as a bioenhancing agent for OCP degrading enzyme production by native fungi. Sandy soil from the Lake Apopka North Shore Restoration Area (NSRA) was taken to the University of Florida and sampled for four months to test the biodegradation rates of p,p' and o,p' isomers of DDE, DDD, and DDT (DDx). Varying increments of beer wort were added to 32 oz. jars containing soil from the study site and degradation of DDx was analyzed to determine which amount of beer wort best enhances the degradative process of DDx. From 0% to 1.8%, DDT degradation increased, with 1.8% showing the most DDT degradation. Past the 1.8% point, degradation decreases. This suggests that there is some inhibitory factor that effects the DDx degradation. Further larger scale studies will be conducted to analyze for nitrate as a possible inhibitor.

ABREVIATIONS USED IN TITLE:

1) DDD = (1-chloro-4-[2,2-dichloro-1-(4chlorophenyl)ethyl]benzene)

2) DDE = (1,1-bis-(4-chlorophenyl)-2,2-dochloroethene)

3) DDT = (1,1,1-trichloro-2,2-di(4-chlorophenyl)ethane)

Obtaining Langmuir Parameters from a Soil Test Solution

B. Dari, V.D. Nair, R.D. Rhue and R. Mylavarapu

Determination of Langmuir isotherms and subsequent calculation of k, the phosphorus (P) bonding strength, and the equilibrium P concentration (EPC_0) of a soil is a tedious and time-consuming process. We hypothesized that k and EPC_0 should be related to the P saturation ratio (PSR) as determined by P, Fe and Al concentrations in an oxalate or a soil test solution such as Mehlich 1 or Mehlich 3. Langmuir adsorption isotherms were constructed for 52 soil samples collected from the Lake Okeechobee Basin and k and EPC_0 values computed. The soils were also analyzed for P, Fe and Al in an oxalate solution and PSR calculated as the molar ratio of P to Fe and Al. The threshold PSR value for these soils is 0.05 with a 95% confidence interval from 0 to 0.1. Results indicate that the k value is high below the threshold PSR and that the value tends to zero after the threshold value. EPC_0 values are minimal below the threshold PSR and increases linearly after the threshold. Therefore it should be possible to obtain EPC_0 and k values at minimal costs by submitting a soil sample to a soil testing laboratory. A simple procedure for determining k would be valuable when such values are needed as input in models for predicting P release from soils.

List of Abbreviation: EPC_0 = Equilibrium Phosphorus Concentration; k = Phosphorus bonding strength;
PSR = Phosphorus Saturation Ratio

Abstract for Soil & Water Science Department Annual Forum, September 7 2012, Gainesville, FL

Fate and Transport of Nitrogen in Onsite Wastewater Treatment Systems

Mriganka De and Gurpal S. Toor

The knowledge about the fate and transport of contaminants like nitrogen (N) in onsite wastewater treatment systems (OWTS) is important to protect groundwater contamination. In Florida, porous sandy soils intensify the transport of N from OWTS to shallow groundwater. To overcome this limitation, elevated disposal fields (commonly called mounds) are constructed on top of the natural soil to provide unsaturated conditions for wastewater treatment. Our objective was to investigate the dynamics of N transport in the vadose zone and groundwater of three OWTS. Our research hypothesis was that the different characteristics of vadose zone (physical, chemical, and microbial) may result in differential attenuation of N by different processes. We constructed three mounds (drip dispersal, gravel trench, and advanced) using two rows of pipes (that included 37 emitters/mound) placed 0.3 m apart in the center of 6 m x 0.6 m drainfield. Each mound received 120 L of septic tank effluent (STE) (equivalent to maximum allowable rate 3 $L/ft^2/day$) from our office and graduate homes. Soil-water samples were collected from the vadose zone by using suction cup lysimeters installed at 0.30, 0.60, and 1.05 m depth, while groundwater samples were collected by using piezometers installed at 3-3.30 m depth. Samples were collected during May-Aug 2012 before STE delivery (3 events at 2-3 days intervals) and after STE delivery (10 events at 2-3 days intervals; 10 events at weekly intervals). Collected samples (STE, soil-water, and groundwater) were analyzed for pH, EC, chloride (Cl), and inorganic N fractions. The range (n = 23) of pH, EC, and Cl of STE were 6.9-7.7, 1.01-1.33 dS/m, and 56-177 mg/L, respectively. The pH (6.33-6.92) and EC (0.48-0.78 dS/m) in lysimeters were lower than STE. The pH (4.30-4.78) and EC (0.29-0.38 dS/m) of groundwater was much lower than both STE and soil-water. Mean (n = 23) concentrations of NH_4-N and NO_3-N in the STE were 52.3 and 0.06 mg/L, respectively. Chloride breakthrough was observed after initial three events in the vadose zone and 28-30 days in groundwater. At 0.3 to 1.05 depths, mean concentrations of NO_3-N were lower (0.1-3.4 mg/L) before STE delivery, but slowly increased after STE delivery (up to 65 mg/L). After STE breakthrough, 39% of total STE NH_4-N was nitrified at 0.3 m depth and remainder 61% NH_4-N may have been taken by abundant plant roots, subjected to microbial uptake, and/or fixed in soil or organic matter. While 92% of total STE NH_4-N was nitrified at 0.6-1.05 m depth. Groundwater received 4-8 mg/L of NO_3-N before till 14 events that occurred before STE breakthrough. After STE breakthrough, NO_3-N increased to 25 mg/L. In all mounds, concentrations of NH_4-N in lysimeters (0.02-0.80 mg/L) and piezometers (0.01-0.72 mg/L) were <1.0 mg/L, suggesting that about >99% of NH_4-N disappeared in <1.05 m depth of vadose zone. Our ongoing research is focused on understanding the mechanisms of N attenuation, evaluating mass balance of N in mounds, and characterizing organic N species in vadose zone and groundwater.

Effect of fertilizer management strategies on color and quality of St. Augustinegrass

N fertilizer is very important to maintain the aesthetic quality of turf. Thus this research was conducted at Citra, Florida to evaluate the effects of different N fertilizer management strategies on grass color and quality. Six fertilizer treatments were laid out in randomized block design with four replications. Color and quality were assessed visually. Value 1 was assigned for brown and dead grass, and 9 for dark green and dense grass. Both color and quality parameters were evaluated for four fertilizer cycles, i.e., March-May (first), June-July (second), August-September (third), and October-December (fourth). Both, fertilizer cycles and fertilizer treatments had significant effects on turf quality and color. The lowest quality and color were observed during the first cycle (5.95 and 6.29) whereas the highest values were observed for the third cycle (7.31 and 7.43). The no-fertilizer treatment led to low (below acceptable limit) quality and color for every fertilizer cycle. For the first cycle significant differences were not observed in color and quality between fertilizer treatments (excluding control). However, differences were observed for the rest of the cycles. In the second cycle, soluble fertilizer @ 195 $kg{\cdot}ha^{-1}$, Polyplus@ 195 $kg{\cdot}ha^{-1}$ and Polyon @ 244 $kg.ha^{-1}$ had comparable (7.88) but higher color ratings compared to other treatments. However, during the third and fourth cycles, darker color was observed for Polyon @ 244 $kg.ha^{-1}$ (8.08 and 7.74) compared to soluble (7.75 and 7.39) and Polyplus (7.74 and 7.36), respectively. Turfgrass color and quality responded similarly to fertilizer treatment and fertilizer cycle.

Abbreviations:

N: Nitorgen

$kgha^{-1}$: Kilogram per hectare

Authors:

Rajendra Gautam, George Hochmuth and Laurie Trenholm

Testing organic soil amendments to grow sugarcane on sandy soils in the Everglades Agricultural Area

Susanna M. Gomez, Samira H. Daroub, Jehangir H. Bhadha, Timothy A. Lang,

Abstract

Sustainable farming techniques, such as using agricultural by-products as organic fertilizer, could improve water quality exiting farms in south Florida by applying less inorganic fertilizers. The purpose of this study is to promote sustainable farming within the Everglades Agricultural Area (EAA) and test the feasibility of amending sandy soils with three organic agricultural by-products: mill mud, mill ash, and floating aquatic vegetation (FAV). We hypothesize that these amendments will add organic matter and increase microbial activity, therefore adding nutrients to sandy soils to create advantageous conditions for sugarcane growth. The study is a twelve-month mesocosm experiment in which sugarcane is grown using mill mud, mill ash, and FAV as a soil amendment at a high, medium, and low application rate. The composition of each amendment and their effects on soil structure and chemistry, plant growth, and the microbial community will be compared to a control containing diammonium phosphate, the conventional fertilizer used to grow sugarcane on sandy soil. Soil tests include pH, organic matter, water holding capacity, cation exchange capacity, total P, mehlich-3 P, and total kjeldhal nitrogen. Microbial analyses include microbial biomass carbon, microbial biomass-P, and phosphatase activity. Plant growth will be determined by measuring plant height, number of stalks, leaf nutrient composition, and sugar content. At the end of the study, we will be able to determine the effectiveness of mill-mud, mill-ash and FAV and the optimum rate of application to sustain a healthy growth of sugarcane on sandy soils.

Impact of P gradient and anoxic conditions on temperature sensitivity of enzyme kinetics in wetland soils

Swati Goswami, Dr. Patrick Inglett, Dr. Kanika Sharma Inglett

Soil microbial extracellular enzymes play an important role in the initial stages of organic matter decomposition and therefore regulate nutrient cycle processes. Because enzyme activities may be affected by temperature and nutrient concentrations, we measured the Michaelis Menten Kinetics [maximal rate of velocity (V_{max}) and half-saturation constant (K_m)] of six enzymes involved in soil organic matter decomposition (phosphatase, phosphodiesterase, ß-D-glucosidase, cellobiohydrolase, leucine aminopeptidase, N-Acetyl-ß-D glucosaminidase) in different nutrient(P) concentration both aerobically and anaerobically in wetland soils. We hypothesized that the temperature sensitivity of the enzyme changes with the biogeochemical conditions including water level and nutrient condition. Furthermore, we tested specific hypothesis that higher P concentration will initiate more C demand for microbes leading to higher V_{max} value for carbon processing enzymes in high P site. Our results indicated higher V_{max} and lower K_m values for both ß-D-glucosidase, and cellobiohydrolase enzymes in P enriched soils. This suggests stimulation (production and efficiency) of carbon-processing enzymes to access more carbon in soils with easily available P. For all enzymes although the V_{max} values increased with temperature, the K_m values did not follow the same trend. The (Q_{10}) values for V_{max} and K_m (for all enzymes) under both aerobic and anaerobic condition ranged from 0.6 to 3.2 and 0.5 to 2.5 respectively. Our results showed higher Q_{10} values for V_{max} relative to K_m.

2012 Soil and Water Science Symposium

Julia "Ky" Gress, doctoral student

Dr. Lena Ma, advisor

Title of poster: A chemical risk reduction education program for residents living near the Koppers superfund site in Gainesville, Florida

Abstract

The Koppers Superfund site, listed on the NPL in 1983, operated as a wood treatment facility for nearly 100 years before closing in 2010. Widespread soil and water contamination resulted from improper waste disposal, soil leaching and surface run-off into an adjacent creek. In 2009, it was discovered that dioxin has been carried off-site on windblown dust and contaminated nearby yards and possibly inside homes. The extent of the dioxin contamination is still unknown as soil and house dust testing continues. Over 300 low-income residents of the nearby neighborhood are known to be impacted and yards are slated for clean-up in 2013. Issues associated with living near Koppers have been aggravated by a lack of easily accessible information regarding the extent and nature of the contamination, the proposed clean-up and relevant policy decisions . The Gainesville Environmental Health Education Project was developed to facilitate and enhance the exchange of information about the dioxin contamination, with the goal of empowering residents to make informed decisions that reduce their risk of health effects associated with exposure to dioxin in the environment. This project was supported by an EPA Environmental Justice small grant.

Hydrologic Modeling for Evaluating Restoration of Historically Isolated Subtropical Wetlands

Authors: Jing Guan and James W. Jawitz

Abstract:

Phosphorous is the main nutrient attributed to Lake Okeechobee water quality deterioration and eutrophication. Recently, the historically isolated wetlands in the watershed have been highlighted in phosphorus management, for their specific hydrologic and biogeochemical role to runoff retention. But, the P retention capacity of these wetlands has been reduced greatly for ditching and draining for grazing. Hydrologic restoration of these ditched and drained wetlands may promote organic carbon accretion and phosphorus retention by increasing wetland plant biomass. The objective of this study is to develop a predictive model of the dynamics of wetland water stage. This study quantifies hydrologic pathways in these wetlands, simulating the continuous fluctuation of wetland water stage. Through this hydrologic model we can obtain useful implications with vegetation biomass. This study will provide a foundation for a coupled hydrologic and wetland plant biomass model for isolated wetlands, which has implications related to phosphorus management in the Lake Okeechobee Basin.

Rebecca Hellmuth

Research Forum Abstract

Nitrogen Use Efficiency of Silage Corn

Rebecca Hellmuth and Dr. George Hochmuth

In agricultural production, nitrogen fertilizers are applied to crops to increase yields, but only a portion is taken up by the plants. The remaining applied nitrogen is either stored in the soil or lost to leaching, runoff, volatilization, denitrification, and immobilization. One objective of a study performed at the University of Florida Dairy Unit in Hague, FL was to quantify silage corn nitrogen uptake in 2011. For silage corn, nitrogen use efficiency is used to measure the total nitrogen (kg ha^{-1}) taken up by the harvested biomass versus the total nitrogen (kg ha^{-1}) applied. The majority of the nitrogen was applied to silage corn crops through manure effluent and supplemented with inorganic fertilizer at the start of the season. The nitrogen use efficiency of the spring silage corn crop at the Dairy Unit was 48%. Although organic nitrogen in manure effluent is not readily available for crop uptake, organic nitrogen becomes available over time through mineralization. Higher nitrogen use efficiency is desirable to the farmer because it indicates the silage corn has a higher nutritional value in the form of protein for the dairy cows.

Nitrous Oxide Production and Consumption after the Rewetting of Soils in Isolated Wetlands and Surrounding Pasture Upland

Jing Hu, Kanika S. Inglett, Patrick W. Inglett, Mark W. Clark and K. Ramesh Reddy

Isolated wetlands have distinct biogeochemical features with surrounding pasture uplands, including nitrous oxide (N_2O) production and consumption processes in soils. Soil rewetting causes an immediate increase in N_2O emissions, but the responsible production and consumption processes are not well understood. This study was designed to quantify the rates of N_2O production and consumption after rewetting both wetland and upland soils. Laboratory incubation was performed on soils collected from three zones: wetland center zone (Center), transient edge zone (Edge) and pasture upland zone (Upland). Soils were rewetted by distilled de-ionized water (Control), NO_3^- solution (NIT), glucose solution (GLO), and glucose + NO_3^- solution (GAN). Soil N_2O production rates were in the order (high to low) of Edge > Center > Upland in Control and GLO while in the order of Center > Edge > Upland in NIT and GAN. Furthermore, the N_2O production rates of soils from all zones were significantly increased in NIT and GAN, but not in GLO, comparing to that in Control. Accumulated N_2O began to be consumed when the N_2O concentration reached the highest point (H point). H point appeared earliest in GLO, followed by Control and GAN but was not reached during incubation in NIT. Edge Soil had highest N_2O consumption rates in Control and GLO. But N_2O consumption rates were not significantly different among soils from different zones in GAN. This study demonstrated that (1) soils from isolated wetlands and surrounding uplands behave differently in N_2O production and consumption after rewetting; (2) NO_3^- is the key factor limiting N_2O production and subsequent consumption.

Preliminary analysis of ecosystem response to anthropogenic nitrogen deposition in remote watersheds of the northern hemisphere

Yuanyuan Huang, Stefan Gerber

Humans have long been altering the natural nitrogen cycle and more than doubled the input of reactive nitrogen (Nr) to the biosphere. Researches from densely populated areas have begun to unveil the impacts as well as mechanisms by which ecosystems response to anthropogenic nitrogen deposition. Based on isotopic records, it has been shown that even remote watershed sediments of arctic, alpine, temperate and boreal ecosystems in northern hemisphere display signal coherently with the source of anthropogenic sources of Nr, that stems from fossil fuel burning and industrial Nr production. Here we analyze the 15N signal of sediment cores in remote watersheds and ask the question, whether the observed signal is exclusively the result of the changed 15N signature of deposition or if the N cycle in these systems has potentially responded to the higher levels of Nr input or other environmental changes. We built a simple process-based framework with which to test whether observations of the isotopic signal in the sediment records can be reconciled with the assumption of an unchanged nitrogen cycle in these remote systems. Our analysis suggests that losses fractionate more with higher Nr input and results from our model point towards change in N processing in some of these watersheds. Our results show that the inclusion of process-based information allows a more comprehensive interpretation of biogeochemical markers.

Evaluation of current and alternative nitrate reduction techniques in the Caloosahatchee River Basin

Travis Knight
Soil and Water Science Department
University of Florida
Adviser: Dr. Edward Hanlon
Email: tmknight@ufl.edu

Abstract

Nitrate loading due to non-point source runoff is known to cause algal blooms and water quality issues in waterways around the country, including the Caloosahatchee River. Algal blooms can reduce submerged aquatic vegetation, fish populations, and cause potential health risks to humans and other mammals. This poster examines current and alternative nitrate reduction techniques within the Caloosahatchee River Basin based on current literature. Primary sources were reviewed for current and proposed nitrate reduction techniques within the basin. Each technique was evaluated based upon benefits, limitations, and disadvantages. One common limitation is a residence time long enough for denitrification to occur. Conditions affecting residence time needed for denitrification include quantity of labile carbon in the anaerobic zone, nitrate concentration, thickness of aerobic soil layer, microbial population and temperature. Additional limitations include available land, current land-uses, and preexisting nitrate levels on the land being used. Available land is increasingly harder to find with growing development and urbanization. The use of agricultural lands to remove nitrate requires a means of circulating nitrate out of the system, such as vegetative crops that assimilate nitrate and are harvested as the crop matures. If the land is being used as pasture, little nitrate is circulated out of the system, with the exception of runoff. Each technique has limitations, therefore proper planning needs to occur to efficiently implement any of the techniques discussed. The use of techniques jointly with production crops can have multiple benefits, lowering the cost benefit ratio.

Algae Nutrient Limitations in Reverse Osmosis Pretreated Landfill Leachate

Carlos V. Lopez and Ann C. Wilkie
Soil and Water Science Department

Landfill leachate accumulates on the bottom liner of municipal solid waste landfills as liquid percolates through the solid waste within the landfill. Landfill leachate poses an environmental threat to surface and groundwater quality and must be managed even after landfill closure. Currently, the Alachua County Southwest Landfill is testing an experimental 2-stage reverse osmosis system for physical removal of leachate contaminants. Reverse osmosis (RO) uses high-pressure membrane filtration, which is an energy intensive remediation method. Ammonia is a primary contaminant of the landfill leachate, and a 2-stage RO system is necessary in order to approach groundwater cleanup target levels. However, despite the 2-stage remediation system, ammonia levels are not reduced sufficiently to meet the groundwater cleanup target levels of 2.8 ppm. An alternative to using the second stage of the RO system is the implementation of biological remediation to utilize residual ammonia in the filtered product from the first stage of RO. This primary permeate provides the necessary nitrogen in the form of ammonia for algal cultivation. A native algal culture collected on site was utilized in laboratory bioremediation experiments to investigate photosynthetic microalgae as a potential biological pathway for remediating ammonia within first-stage RO pretreated landfill leachate. Testing demonstrated that growth and ammonia remediation are restricted by a lack of essential elemental nutrients. However, when algal cultures growing within primary RO permeate were supplied with a complete nutrient medium, growth and biological remediation improved.

TITLE: Utilization of Novel Analytical Approaches to Determine Soil Organic Matter Stability in Wetlands

AUTHORS (FIRST NAME, LAST NAME): Anna Evangeline Normand[1], K. Ramesh Reddy[1]
INSTITUTIONS: 1. University of Florida, Gainesville , LA, United States.
ABSTRACT BODY:

One of the most complex challenges in environmental science is determining the molecular composition of organic matter in soils and sediments. Organic matter plays a key role in the function of wetland soils: it regulates the binding and release of nutrients and anthropogenic chemicals, affects biological activity, and influences the soil physical properties. Organic matter in wetlands has received increasing attention due to its role in the global carbon (C) cycle by sequestering C and its regulation of nutrient fluxes affecting ecosystem eutrophication. Therefore, it is advantageous to further our understanding of this critical wetland soil component. As insight to organic matter evolves, questions pertinent to global environmental processes should be addressed: What are the biotic or abiotic mechanisms that will foster the accretion and stability of organic matter? How stable is “recalcitrant” organic matter and what environmental changes may prompt its degradation?

To progress our knowledge of wetland soil organic composition and processes, we must employ the most advanced techniques available within research means. This review briefly addresses operationally defined fractionation pools, and then proposes advanced techniques that are the most advantageous to investigate organic matter in soil. Advanced spectroscopic techniques presented include Nuclear Magnetic Resonance (NMR), X-ray Absorption Near Edge Spectroscopy (XANES), and Mass Spectrometry (MS). The basic theory, specific advantages and disadvantages, and application of each technique to study organic matter in wetlands are explained. Finally, the integration of multiple techniques and organic soil components is stressed.

Ongoing research will investigate the key couplings and feedbacks of anthropogenic and natural drivers on cycling of macroelements in wetland organic matter, and how these relationships affect reactivity, stores, and fluxes of these elements. Targeted field sites will include peat wetlands in tropical, temperate, and arctic climates. Ombrotrophic, minerotrophic, and surface water dominated wetlands will be sampled. Molecular organic matter composition will be analyzed using operationally defined fractionation and advanced techniques.Then, manipulative laboratory experiments and in situ field studies will be conducted on bulk soil samples to determine effects of external drivers on the peat soil composition.

Anna E. Normand
University of Florida, Soiland Water Science Department, Wetland Biogochemsitry Laboratory,106 Newell Hall, P.O. Box 110510, Gainesville, FL 32611 USA, Phone: 352-392-1803 Fax: 352-392-3399 Email: evangeline@ufl.edu

Tracking Nitrogen using SUBSTOR : A model based approach for improving nitrogen management for potato cultivation in the Suwannee River watershed

Rishi Prasad[1], George Hochmuth[1] and Christopher Martinez[2] (1) Soil and water science, University of Florida, Gainesville, FL, (2)Agricultural and Biological Engineering Department, University of Florida, Gainesville, FL .

Potato (*Solanum tuberosum L*.) is among the top 10 vegetable crops in Florida with a high crop value. Potato production in Florida occurs under irrigated, predominantly centre pivot, and most of it on coarse textured, low organic matter sandy soils. These sandy soils have poor water and nutrient holding capacity and hence are vulnerable to nitrate-N leaching if water and N are applied in excess and or poorly managed. According to the Suwannee River Partnership, nitrate levels in the middle Suwannee River Basin have increased over the last 15 years. Hence there is a need to evaluate the production practices of farmers in the Suwannee River area which will help in evaluating and developing improved N best management practices. The objective of this study was to evaluate the potato production practices relating yield and nitrogen balance for the growing season 2010 for a commercial farm in northern Florida using the SUBSTOR model in DSSAT. The output data predicted from SUBSTOR-potato model were in harmony with the observed data for tuber dry weight, tuber fresh weight, tuber N at harvest, and N uptake during the growing season. The major N loss pathways as predicted by model included a leaching loss of 102 kg/ha N, ammonia volatilization of 21 kg/ha N and denitrification loss of 0.15 kg/ha N. The accounted loss was 34 % of the total N input.

Assessing Terrestrial Carbon Dynamics and the Effects of Climate Driven Changes on Carbon Stocks across the Southeastern US

C.W. Ross, S. Grunwald

Anthropogenically induced global warming is well documented and there is growing concern that continued warming may alter climate patterns, resulting in a redistribution of carbon (C) stocks and ecosystems. In the Southeastern US, temperatures are expected to increase by 2.5 - 5° C by the end of the century. Additionally, precipitation is expected to decrease by 20% during summer months as a result of climate warming. The effects of climate change conditioned drought and wildfire on terrestrial C dynamics are not well understood and the uncertainties of modeling C dynamics across large regions are extremely high.

In the proposed project we will test various hypotheses related to how soil moisture and fire regimes conditioned by climate change will impact soil C dynamics. Our objectives include: (1) investigate soil C dynamics along trajectories of soil moisture/hydrology and fire regimes which are projected under climate change scenarios in a prominent southern pine ecosystem (FL), (2) investigate the disturbance effects of fire on C stocks, structure and function in pine ecosystems, including above and belowground components; and (3) compare deterministic and mechanistic models to upscale site-specific changes in C stocks and budgets to the Southeastern U.S.

The overarching goal of this project is to improve the understanding of terrestrial C dynamics and potential effects of climate driven changes on soil moisture and fire regimes in the Southeastern USA. This information will aid land managers in implementing best management practices to increase C sequestration while increasing forests resilience to climate change stressors.

Use of Al-WTRs in ermeable reactive barriers to limit phosphorus movement in groundwater in the Lake Okeechobee Basin

William Schmahl and James W. Jawitz
Department of Soil and Water Science, University of Florida, Gainesville, FL, USA

High phosphorus (P) loading in Lake Okeechobee in the past has resulted in advanced eutrophication with corresponding impacts on the lakes ecosystem. The majority of this P loading is sourced from agricultural and livestock operations in the northern Lake Okeechobee basin (LOB). The main source of P is from cow manure resulting from intense livestock operations or from use as fertilizer. In many soils the P is bound within the soil however the Spodosols of South Florida lack the capacity to retain much P and a large percentage of the soluble P is leached through the soil, and transported via groundwater to the surface water drainage network and eventually into Lake Okeechobee. Our project involves the use of aluminum oxide water treatment residuals (Al-WTRs) installed in a trench perpendicular to groundwater flow to inhibit the movement of the soluble P. The attributes of Al-WTRs are such that the P will readily adsorb to the aluminum oxides and will remain stable over long periods of time. The Al-WTRs are available locally and cost effectively making this an attractive method for P removal.
Our first PRB was built on the Candler Ranch and was field-tested for a year. Despite seeing high P removal in the center of the PRB there was not sufficient groundwater flow to show P removal through the PRB. A second PRB has been installed at the Butler Oaks Ranch, this area has a higher groundwater gradient which should show groundwater movement through the PRB and the expected P adsorbtion.

Contact Information:William Schmahl, Soil & Water Science Department, University of Florida, PO Box 000, Gainesville, FL 32611, USA; Phone: 000-555-5555; Fax: 000-555-5000; Email: willschmahl@ufl.edu

Dislodgeable Residues of Endocrine Disrupting Chemicals on Turfgrass Irrigated with Reclaimed Water.

Harman Sidhu, Chris Wilson, George O'Connor

Endocrine disrupting chemicals (EDCs) are frequently detected in reclaimed water and use of reclaimed water to irrigate residential lawns raises concerns of potential human exposure from dislodgeable concentrations of EDCs. Dislodgeability of five EDCs (estrone, 17ß-estradiol, 17α-ethylestradiol, bisphenol A, nonylphenol) from St. Augustine turfgrass was studied using hand wipe and drag-sled methods. A lawn area with St. Augustine turfgrass was divided into five 2×1.2 meter replicates. Nanopure water spiked with the five EDCs was sprayed over the area using a compressed CO_2 backpack sprayer. The final masses of estrone, 17ß-estradiol, 17α-ethynylestradiol, bisphenol A, nonylphenol per sampling area were 34 ng, 60 ng, 60 ng, 160 ng and 160 ng ,respectively, for the hand wipe method (sampling area of 200 cm^2); and 67 ng, 100 ng, 100 ng, 267 ng and 267 ng, respectively, for drag-sled method (sampling area of 333 cm^2). Samples were collected from individual replicates before spray, just after spray, four hours after spray, eight hours after spray, and after rewetting with nanopure water eight hours after initial spray. Extracts were analyzed using GC-MS. Dislodged EDCs were detected using both sampling methods immediately after spray with average masses of 0 ng, 75 ng, 34 ng, 110 ng, and 120 ng for hand wipe method and 8 ng, 15 ng, 0 ng, 85 ng and 210 ng for the drag-sled method for estrone, ß-estradiol, 17 α- ethylestradiol, bisphenol A and nonylphenol, respectively. Dislodgeable masses decreased with time. Concentrations were less than the limit of detection eight hours after application for all the compounds. However, dislodgeable residues of bisphenol A reappeared (85 ng for hand wipe and 92 ng for drag-sled method) after rewetting of the plot. This study demonstrates that EDCs were most available immediately after application to grass. Dislodgeable residues of estrone, 17ß-estradiol, and 17α- ethynylestradiol decreased with time; whereas dislodgeable residues of bisphenol A and nonylphenol dissipated more slowly and depended on wetting of foliage.

EDCs - Endocrine disrupting compounds.

CO2 - Carbon-di-oxide.

ng - Nanogram.

Temperature sensitivity of greenhouse gas (CO_2 and CH_4) production and flux in a subtropical wetland: the importance of organic matter quality and nutrient availability

D Sihi, P W Inglett and K Inglett

Gaseous carbon release from soils is affected by substrate quality, nutrient availability and temperature. This study investigated interaction of temperature with organic matter quality and nutrient availability at temperatures ranging from 15°C to 30°C in two freshwater *Cladium*-based peat soils. To assess proportion of carbon considered available at a given temperature the experiment is conducted by ramping up temperature @ 5°C at each step. Gaseous C production estimates are arrived by anaerobic incubation of samples collected from surface (0-10 cm) and subsurface (10-20 cm) soil. Simultaneously another experiment is conducted with intact soil cores with same temperature ramping up to get gaseous carbon flux. Surface and subsurface soil samples are collected from high phosphorus and low phosphorus site. Results indicate that poor substrate quality (subsurface soil) limits gaseous carbon production, even though the peat is >98% organic matter at both depths. Higher rates of gaseous carbon production and flux are observed from high phosphorus site. Though total gaseous carbon production and flux increased with temperature increment, initially increasing temperature from 15 to 20°C increases CH_4 production and flux disproportionately relative to CO_2 production and flux. Higher Q_{10} value observed for CH_4 production (~17) and flux (~3) compared to CO_2 production (~1.9) and flux (~1.2). Outcome of this research would advance our understanding of carbon cycle and has implications for C models in Wetlands.

Assessing the Fertilizer Value of Anaerobic Digester Effluent

Reginald Toussaint[1] and Ann C. Wilkie[2]
[1]School of Natural Resources and Environment
[2]Advisor, Soil and Water Science Department

As the human population continues to grow, an increased reliance on agricultural inputs, particularly fertilizers, is anticipated to sustain increasing levels of global food production. Current fertilizer production is energy intensive and uses non-renewable resource inputs. Recycling plant nutrients from organic waste is an elementary alternative to reduce the demand for synthetic fertilizers. Anaerobic digestion of organic waste generated on-farm simultaneously produces a renewable energy source, biogas, and a liquid fertilizer co-product, anaerobic digester effluent (ADE). Utilization of ADE and biogas alleviates greenhouse gas emissions through the offset of conventional fertilizer production and the direct displacement of fossil fuels, respectively. The effluent of an anaerobic digester treating food waste and crop residues was analyzed for major plant nutrients. ADE contained 486 mg/L of total Kjeldahl N, 85 mg/L of P and 374 mg/L of K. ADE can supply 200 lbs.N/acre, 112 lbs.P_2O_5/acre and 260 lbs.K_2O/acre at an application rate of 2.5 inches/acre. At this rate, ADE supplies 100% of the N and K and 74% of the phosphorus for beans or onions. An increase of the application rate up to 3.4 inches/acre could provide all recommended nutrients for these crops. The yields of beans and onions were compared in a complete randomized field study under different fertilization regimes: ADE, urea, fish emulsion, and a control group receiving no fertilizer. Yields for onion and bean crops grown under ADE fertilization were not significantly different from yields using either urea or fish emulsion and validate the use of ADE in crop fertilization.

Modified Method for the Characterization of Soil Organic Nitrogen in Wetlands

Christine M. VanZomeren and K. Ramesh Reddy, University of Florida, Gainesville, FL

Soil organic nitrogen (SON) is an important component of soil organic matter and serves as a major source of N to biotic communities. In spite of its importance, SON is not well characterized, primarily due to methodology limitations. The operationally defined method for characterizing SON uses hydrolysis with acid and analysis of extracted N fractions using a steam distillation procedure. Acid hydrolysis accounts for less than 60% of SON and the remaining 40% is unaccounted for. The total hydrolyzable N (organic N extracted with acid) is further fractionated into ammonia N, amino acid-N, amino sugar-N, and unknown hydrolysable N. More recently, advanced techniques, such as solid-state ^{15}N nuclear magnetic resonance spectroscopy and Atmospheric Pressure Photoionization Fourier Transform-Ion Cyclotron Mass Spectrometry, have been used to characterize SON. However, these techniques have their own limitations, such as cost and instrument time. As suggested by the labor intensive steam distillation procedure and expensive spectroscopic techniques, a standard, cost effective, and easily reproducible method for quantifying SON is needed. Therefore, we propose a modified acid hydrolysis method for characterizing SON, specifically for wetland soils. The proposed method includes acid hydrolysis with 6 *M* HCl by heating samples in an oven at 100˚C, filtering, and then determining SON fractions. Characterization of SON is then determined with procedures for TKN, ammonia-N, amino acid-N, and amino sugar-N by colorimetric methods. The proposed modified method for wetland SON characterization will be presented.

Impacts of Land Use on Ecosystem Carbon in Subtropical Grassland Ecosystems

Sutie Xu (PhD Candidate, UF, Soil and Water Sci. Dep.), Maria L. Silveira (Associate Professor, UF, Soil and Water Sci. Dep.), and Kanika S. Inglett (Research Assistant Professor, UF, Soil and Water Science Dep.)

Abstract

Land use intensification has often major impacts on plant communities and soil characteristics, particularly soil carbon accumulation and long-term storage. Despite the ecological significance, research focused on the effects of grassland intensification on C cycling in subtropical ecosystems is still scarce. Florida grasslands store appreciable amounts of C and can contribute to climate change mitigation; however because the unique climatic conditions and soil characteristics, the processes controlling C accumulation and losses in Florida are different than temperate regions. The objectives of this research are to i) investigate the long-term effects of land use intensification on plant biomass, soil organic C stocks and characteristics, and microbial community in subtropical grasslands. The experimental sites consisted of three grassland biomes: native rangelands, silvopasture, and intensively-managed improved pastures located at the UF/IFAS Range Cattle Research and Education Center in Ona, FL. In this study, above- and below-ground plant biomass, soil organic C stocks, particulate organic carbon, stable isotope analysis ($\Delta^{13}C$), microbial biomass C, and microbial phospholipid fatty acid (PLFA) will be analyzed. It is expected that C storage will increase as grassland intensification decreases. Less intensive ecosystems such as native rangeland and silvopasture will likely have greater C above- and below-ground C inputs as compared to intensively-managed pastures. We also expect that the chemical composition of the C inputs and microbial composition and activity will vary depending on the ecosystem. Results from this research effort are expected to help elucidate ecosystem C responses to long- term land use intensification in subtropical grassland ecosystems.

Tracer tests to predict DNAPL storage and release from low permeability zones

Minjune Yang, Michael D. Annable, and James W. Jawitz

Contaminants from low-permeability zones have been considered to be secondary sources after primary sources are removed or isolated at DNAPL remediation sites. Unfortunately, it is difficult to remove contaminants in low permeability zones, and thus, back diffusion has recently been shown to be a potential limitation to DNAPL remediation. This is because the mass diffused out from the low permeability zones results in increased plume persistence. The resulting contaminant flux depends on the contact area between low and high permeability zones. Therefore, laboratory and modelling efforts are necessary to demonstrate prediction of plume response and back-diffusion between high and low permeability zones. In this study, a back diffusion experiment was performed using a well-controlled laboratory flow chamber (28 cm × 14 cm × 1.5 cm) for flow visualization and tracer tests. The flow chamber was filled with well- characterized 20/30 mesh Accusand with a thick upper layer of kaolinite. A tracer solution of 200 mg/L of bromide and erioglaucine was selected based on batch adsorption tests. In addition, the one-dimensional diffusion model of *Brown et al.* [2012] was used to investigate plume response and back diffusion between high and low permeability zones. The analytical solution using a power law source depletion model was applied to predict the mass transport from low permeability zones. Close predictions between the analytical solution and measured tracer data would suggest that the analytical solution could be used to characterize the back diffusion and plume persistence controlling the analytical solution parameters.

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