Potential Remediation of Contaminated Surface Waters Using *Acorus gramenius* (Japanese Sweetflag) and *Canna hybrida* 'Orange Punch'

Authors: Noha Abdel-Mottaleb and Dr. P. Chris Wilson

Acetaminophen, carbamazepine, sulfamethoxazole, estradiol, perfluoroocatanoic acid, and atrazine are often detected in wastewater treatment effluent and surface waters receiving wastewater and reclaimed water. Conventional remediation techniques are often impractical for non-point source contaminants and for compounds with no water quality regulations. One possible remediation technique under evaluation is the use of floating islands established with ornamental wetland plants. Mass balance studies were conducted to characterize the potential uptake of 14C-labelled acetaminophen, carbamazepine, sulfamethoxazole, estradiol, perfluorooctanoic acid, and atrazine by the ornamental wetland plants, *Acorus gramenius* (Japanese Sweetflag) and *Canna hybrida* 'Orange Punch'. Observed reductions of each contaminant in hydroponic solutions over a 14 day exposure period were: 20% (atrazine), 26% (carbamazepine), 40% (perfluorooctanoic acid, PFOA), 60% (sulfamethoxazole), 60% (estradiol), and 100% (acetaminophen) for *Acorus gramenius*. For Canna, the reductions in contaminant concentrations in the hydroponic exposure solutions were 51% (atrazine), 41% (carbamazepine), 34% (PFOA), 40% (sulfamethoxazole), 74% (estradiol), and 84% (acetaminophen). Preliminary results suggest that *A. gramenius* and *C. hybrida* 'Orange Punch' may be a good candidates for removing acetaminophen, PFOA, carbamazepine, sulfamethoxazole, and estradiol from contaminated surface water. Future studies will evaluate the disposition of the contaminants within plant tissues to determine potential degradation, as well as remediation efficacy at the outdoor microcosm scale.

A METHANE EMISSIONS MODEL FOR BROAD APPLICATION

Carla Alonso-Contes, Stefan Gerber, Isaac Duerr, Nikolay Bliznyuk

One of the largest sources of methane are wetlands, contributing about 20 to 40 % to global sources. We developed a simple Methane model following the approaches used in more complex global biogeochemical emission models (LPJWhyMe and CLM4Me). The model represents the major processes that lead to methane emissions, these include production of methane in the soil column by microbes, transport through the soil by diffusive gas transport through the soil and through plants (aerenchyma transport), and also oxidation of methane in the soil. One advantage of the model compared to existing ones, is that it uses data instead of complicated model formulations for the two essential drivers plant productivity and hydrology. This simplifies the model considerably and allows us to directly focus on the central processes of methane production, consumption and transport. One of our long term goals is to make the model available to a scientists interested in including methane modeling in their location of study. Another goal is to upscale the model's extent. To make these goals possible we conducted in a first step a global sensitivity analysis on the model output in order to determine which parameters and processes contribute to the model's uncertainty of methane emissions from the soil column. The results show that parameters related to water table behavior, NPP and rooting depth affect the model output the most. By constraining these values, with collected data or remotely sensed data, the model may be a robust tool towards methane prediction at a specific site and to examine observed emissions based on known biogeochemical processes.

PHOSPHORUS FORMS IN FRESHWATER AND ESTUARINE WATERS OF AN URBAN WATERSHED

Sinan Asal and Gurpal S. Toor

Phosphorus (P) is a limiting nutrient in water bodies. Excess P in water bodies can cause environmental and economical issues. Our objective was to determine P forms in freshwater and estuarine waters in an urban watershed that drains to the Tampa Bay Estuary. Water samples were collected from 13 different sampling locations along a longitudinal gradient in the upper, middle and lower sections of Braden River, lower section of Manatee River, and Tampa Bay Estuary from December 2015 to May 2016 (n=6). A fractionation method was used to seperate water samples into dissolved (≤0.45 µm) and particulate (≥0.45 µm) P forms, which resulted in four P forms: dissolved reactive P (DRP), dissolved unreactive P (DUP), particulate reactive P (PRP), and particulate unreactive P (PUP). Among all P fractions, DRP was the most dominant form at all sites (mean: 99 ug/L; 46% of TP), followed by PRP (mean: 59 ug/L; 27% of TP), DUP (mean:39 ug/L; 19% of total P), and PRP (mean:15 ug/L; 8% of total P). The concentrations and proportions of P forms varied over time at different sampling locations. For example, the proportion of inorganic P forms were more variable (DRP: 25-57%; PRP: 5-59% of total P) as compared to organic P forms (DUP: 12-33%; PUP: 3-14% of total P). Total P concentrations at all sampling locations did not exceed the US EPA Numeric Nutrient Criteria thresholds (330–490 µg/L). Results suggest that understanding the sources of different P forms will be a key to devise strategies to control P loss in different P forms.

Looking Inside the Black Box: Effects of Flow and Vegetation Type on Enzyme Activities in Constructed Wetlands of the Florida Everglades.

Sara Baker, Kaylee A. Rice, Kanika S. Inglett, X. Liao and Patrick W. Inglett*

The Stormwater Treatment Areas (STAs) in South Florida are designed to reduce macronutrients, particularly phosphorus (P), from surface waters prior to release into the Everglades Protection Area. Microorganisms are an essential part of nutrient removal through the release of enzymes that convert organic P to available inorganic P; however, the effects of hydrologic flow and vegetation type on enzyme activities is largely overlooked in constructed wetland systems. The objectives of this study include evaluating microbial carbon (C), nitrogen (N), and P decomposition and enzyme activities (C -β-glucosidase, N -Leucine aminopeptidase/β-N-acetylglucosaminidase, P –phosphomonoesterase/phosphodiesterase) in various flow conditions and vegetation types with respect P removal in the STAs. Analysis of enzyme activity in the litter, floc/periphyton, and soils will be used to determine seasonal and spatial patterns of enzyme activities and kinetics (V_{max}, K_m) in areas of submerged aquatic vegetation (SAV) and emergent aquatic vegetation (EAV). Due to the interaction of C/N/P processes, enzyme activities will be compared with measurements of mineralization, respiration, C use efficiency, and microbial biomass and stoichiometric ratios. This research will identify abiotic and biotic factors relating to performance of constructed wetlands and help direct best management practices for operating these systems in the Everglades Protection Area.

Impacts of the abundance of *Candidatus Liberibacter* on the citrus phyto-microbiome and insights to bacterial interactions that could control the pathogen

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Understanding how the citrus microbiome is affected by (and impacts) Huanglongbing (HLB) may be critical to disease management. The objective of this work was to begin to test the hypothesis that bacterial interactions within the citrus phyto-microbiome could be utilized to control the abundance of *Candidatus Liberibacter asiaticus* (i.e., the HLB pathogen). Leaves were collected from HLB-infected Valencia orange trees that differed in extent of disease symptoms, and the host-associated communities were characterized via 16S rDNA high-throughput sequencing. Approximately 1,900 OTUs were detected, representing 215 genera. The relative abundance of genus *Candidatus Liberibacter*, which ranged from 0.7 - 71.3%, induced PCA clustering of communities of native bacteria and negatively correlated with alpha diversity ($p<0.001$) and species richness ($p=0.001$). Network analysis of all genera revealed positive interactions or co-occurrence ($p<0.05$) of *Candidatus Liberibacter* with *Pseudomonas* and an unclassified genus of Oxylobacteraceae. These two, in turn, had negative interactions ($p<0.05$) with 5 genera that formed a complex network of positive interactions with 39 other genera, which likely represent the “stable” phyto-microbiome. These interactions suggest that (1) the impacts of *Candidatus Liberibacter* on the microbiome are likely mediated through its interactions with pseudomonads and oxylobacteria and/or (2) antagonistic effects of the bacteria from the core citrus microbiome on these two groups may lessen the pathogen titer and mitigate disease progression. This work will be extended to define mechanisms and outcomes of key bacterial interactions within the citrus microbiome that are relevant to developing novel bio-based strategies to thwart the HLB pathogen.

Application of Submerged Aquatic Vegetation as Bio-filter for Phosphorous Reduction

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Phosphorus loads from anthropogenic sources including animal waste, fertilizers, and wastewater, increase eutrophication and reduce water quality, especially in freshwater ecosystems where phosphorus is a limiting nutrient. This project seeks to test the ability of submerged aquatic vegetation (SAV) *charra spp.* (muskgrass), *Ceratophyllum demersum* (coontail), and *Najas guadalupensis* (southern naiad) to remove phosphorus from the water column of agricultural field ditches in the Everglades Agricultural Area. These species of SAV are native to South Florida and have been found to reduce phosphorus levels in stormwater treatment areas. By recirculating nutrient-rich canal water through the ditches, our goal is to provide SAV with an optimal hydraulic residence time for phosphorus removal. The four treatment ditches contain SAV and solar powered pumps to recirculate water. The two control ditches will not contain SAV or solar powered pumps. In the treatment ditches it is hypothesized that SAV will absorb nutrients and dissolved phosphorus will co-precipitate with calcium carbonate, which is present due to the underlying limestone. Co-precipitation is expected to occur as SAV photolytic activity increases the pH of the water column. Sediment, water, and SAV samples will be tested for total phosphorous and calcium, while water samples will also be tested for various water quality indicators including soluble reactive phosphorous, particulate phosphorus, total dissolved phosphorus, dissolved organic carbon, total kjeldahl nitrogen, and total suspended solids. This project seeks to demonstrate that SAV can be used as a bio-filter to reduce phosphorous loads from exiting farm canals.

THE EFFECT OF SHORT TERM INUNDATION ON POTENTIAL NITROGEN FLUX IN COASTAL ECOSYSTEMS

R. Collins, R. Mylavarapu, T. Osborne, and M. Clark

ABSTRACT

Excess nitrogen (N) loads are considered one of the greatest threats to the integrity of coastal ecosystems but a variety of influencing factors make the amount and rate of N input to the coast difficult to determine. Explored in this study is the effect of short term inundation on potential N flux from four ecosystems in St. John's County, Florida: submerged, marsh, upland and residential. Four soil cores were collected from each of the four ecosystems. After saturation, each of the cores was inundated with a 10cm head of floodwater. Floodwater samples were then collected after 0, 3, 6, 9, 12, 18, 24, 72, 120 and 168 hours and were analyzed for TKN, NH_4-N and NOx-N to determine the Total Nitrogen (TN) concentration and flux through the study period. Results found no statistical difference in the TN concentration or flux in the floodwater among the four sites after a short term 24-hour inundation. However, at the end of seven days of inundation, the residential and upland TN concentrations and flux were significantly higher than the marsh and submerged ecosystems. These results show that a short term flooding event will have similar effects on N flux regardless of ecosystem, but a longer duration of inundation of a week or more could lead to a significantly greater N flux from the residential and upland ecosystems. This could possibly pose a threat as future predictions in sea level rise leave inland communities vulnerable to increased flooding events and prolonged inundation, causing excess N concentrations in the floodwater to be transported into the coastal waters.

Phytoremediation of As-contaminated soils by As-hyperaccumulator *Pteris vittata*: long-term efficiency and biomass disposal

Authors: Evandro B. da Silva, Jason T. Lessl, Ann C. Wilkie, Lena Q. Ma

Soil and Water Sciences Department

Arsenic (As) is toxic to plants, animals and humans. Therefore, it is important to reduce its exposure to humans. Phytoextraction is a low-cost technology that utilizes hyperaccumulator plants to extract metals from soils. As-hyperaccumulator *Pteris vittata* (Chinese brake fern) can accumulate up to 23,000 mg kg^{-1} As in the fronds. However, disposal of the As-laden biomass might represent a drawback of phytoremediation using *P. vittata*. Its ability in taking up As from three As-contaminated soils was assessed over 6 years using plots containing 162 kg soil, each supporting 9 plants. Arsenic extraction from *P. vittata* biomass was assessed by using water and 30% ethanol. *P. vittata* reduced soil As concentrations by 45-47%, from 129, 26.6 and 29.8 mg kg^{-1} to 69, 16 and 14 mg kg^{-1}. After 3 years, As accumulation in *P. vittata* fronds decreased probably due to labile As being depleted. Over time, the As from the amorphous fraction exhibited the highest decrease, showing the unique ability of *P. vittata* to solubilize non-labile As in soil. Arsenic in *P. vittata* biomass was ~60% water soluble and 85% ethanol soluble. Addition of $MgCl_2$ helped formation of magnesium arsenate precipitate [$Mg_3(AsO_4)_2$], reducing solution As concentration to < 2 mg L^{-1}. *P. vittata* was effective in remediating As-contaminated soils and ethanol was efficient in extracting As from *P. vittata* biomass.

TEMPERATURE SENSITIVITY OF DENITRIFICATION IN SANDY PASTURE SOILS

D. Katelyn Foster, Xiaolin Liao, Patrick W. Inglett*

With the increasing rise of nitrate levels in groundwater, it is important to understand its origin, transport, and fate. Denitrification is an effective form of nitrate removal facilitated enzymatically by microorganisms, and is strongly temperature dependent, especially in sandy soils with low water holding capacity. This study focused on identifying how temperature controls denitrification enzyme activity in sandy pasture soils of high (HD) and low (LD) manure loading rate. The effect of temperature (as apparent Q_{10}) was compared at various moisture levels ranging from 22%to 50 % water-filled pore space. We hypothesized that differences in major N processes (mineralization, nitrification, oxygen demand) between the two systems would alter the temperature sensitivity. When comparing the two soils, the rate of denitrification was always higher in the HD pasture regardless of temperature or %WFPS. For both soils, denitrification increased exponentially with temperature, with the exception of LD- 35% WFPS. The Q_{10} values for both soils were higher than 2, with the LD soil at approximately 4.6 and showing no significant trend with %WFPS. The HD soil Q_{10} value ranged from 39-140, with an overall decrease in the value with increase in %WFPS. Compared to other studies in sandy soils, as expected, denitrification rate was affected by temperature more than %WFPS. Increasing %WFPS also increased denitrification, except for the HD pasture, where under warmer temperatures (20, 25^{o}C) rates decreased with increasing moisture. The results are currently unexplained, but the findings of this study will help improve models of soil denitrification in N mass balances, and help direct potential mitigation strategies.

Solid State and Solution Chemistry to Evaluate Phosphorus Release from Biochars

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Land-application of biochar, a product of biomass heating, has recently been promoted as a sustainable agricultural practice that improves soil health and crop yield. However, the diversity in biochar feedstocks may confer different abilities in desorption of phosphorus (P). Our objective was to evaluate P associations in different biochars as well as its desorption when mixed with distinct soils. Mineralogical assessment (XRD) and elemental association (SEM-EDS) were performed in conjunction with desorption experiments in order to assess the mechanisms by which P is held. The desorption experiment was performed by mixing 1% (w/w) biochar from feedstocks of poultry litter (PLB), biosolids, mixed hard woods (HWB) and pure maple with two contrasting soils followed by repeated 0.01 M KCl extractions. The total P concentrations were: 25 615, 67 330, 1898 and 730 mg kg^{-1} for PLB, biosolids, HWB and maple biochars, respectively. Magnitude and pattern of P release depended on the biochar and soil type. The mineral whitlockite in PLB was indicated by XRD and corroborated by SEM-EDS analyses; solution analysis indicated a long-term P release consistent with the sparingly soluble mineral. Association between Mg and P in biosolids biochar was evident from SEM-EDS, consistent with XRD indication of struvite in the raw biosolids. No associations between P and other elements could be confirmed for HWB or maple biochars. All biochars released P rapidly initially, but levelled off after the first few extractions. Based on solid phase and solution chemistry, field application of biochar should take into consideration both the biochar and soil type to minimize environmental problems of over application of P.

A Discussion of Methods of Stakeholders' Mental Models of Soil Management Relating to Food Security in India.

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In 2015, there were 795 million people who were undernourished with a majority located in developing countries. The Food and Agricultural Organization of the United Nations expects agricultural production will need to be increased by 70% to meet the global food demand in 2050 with a population of 9.1 billion. Past solutions to global food security had unintentional consequences such as the dust bowl, dead zone in the Gulf of Mexico, lost of traditional farming systems and lost of biodiversity. Local knowledge held by farmers is more specific to the local ecosystem and can predict consequences of change in soil management. Understanding farmer, scientist, and extension agents beliefs is essential to increasing food security by limiting unintentional consequences and improving communication between the stakeholders. This study uses the cultural models theory from cognitive anthropology to understand the belief systems of soil management relating to food security of stakeholders in six villages facing urbanization in Telangana, India. The Integrated Farmer Participatory Watershed Management Model (IFPWM) was development by ICRISAT and was first implemented in these communities starting in 2014 as part of a five year project. Interviews, observations, soil data, and trace measures were used to collect data on the belief systems of IFPWM stakeholders. The results of this study are multiple mental models of the IFPWM stakeholders. The results can also be used to focus future soil science research to meet global food demand.

Background Concentrations of Polycyclic Aromatic Hydrocarbons and Heavy Metals in Florida Urban Soils.

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Polycyclic aromatic hydrocarbons (PAHs) result from phytogenic, petrogenic and pyrogenic sources in the environment. Generally, anthropogenic factors have the most impact on PAH distribution in urban areas, whereas natural factors affect their distribution in remote areas. These organic chemicals are ubiquitous and pose a risk for human health because of their potentially carcinogenic nature and availability in the environment that humans come in contact. Among all the environmental matrix, soil is the most important sink for PAHs. This is because PAHs are hydrophobic, semi-volatile, readily adsorbed by soil particles, and resist degradation. It has been estimated that approximately 90% of total residues remain in the soil. In addition, heavy metals are also a problem in soils. At elevated concentrations, heavy metals are toxic to humans. Due to their non-biodegradable nature and long biological half-live of elimination from the body, their contamination in the environment is of concern. Heavy metals and PAHs often co-exist in contaminated soils, some of which have different chemical properties, modes of toxicity, and potential to interactions with soils. Exploration into the effects of metal mixtures has revealed that non-additive toxicity is common and complicates attempts to address the risk assessment posed by environmental contamination of metal mixtures. It is even less clear when trying to assess the risks associated with mixtures of metals-PAHs. This study will discuss the background concentrations and distributions of PAHs and heavy metals in urban soils in Florida State.

TITLE: Pedogenic and spatial characteristics of a massive and understudied soil carbon pool

AUTHORS: Yaslin Gonzalez, Allan R. Bacon, and Willie G. Harris

Soil is the largest terrestrial pool of carbon (C) in the biosphere. Accordingly, policy makers, land managers, and Earth scientists are keenly focused on soil C stocks and cycling to forecast and manage Earth's C cycle. Here, for the first time, we compile all known observations of a massive and previously unaccounted for pool of soil C in the Atlantic Coastal Plain, referred to as the B'h horizon. We conduct a regional biogeochemical meta-analysis and spatial analysis of the B'h horizon to determine how much C is stored in the horizon, how it accumulated, and where the horizon exists in the Atlantic Coastal Plain. We find that on average the B'h horizon contains nearly 70 Mg C ha^{-1}. Although this estimate is highly conservative, it amounts to more C than any other mineral soil horizon in the region, and even more C than the top meter of permafrost soils. We use sand size distributions and organic C extractions to demonstrate that the B'h horizon results from deep C translocation rather than burial. Finally, we show that B'h horizon exists predictably across the region, in close association with relict shoreline features created by changes in sea levels over the last five million years. This study demonstrates that the B'h horizon can no longer be ignored, if we aim to effectively manage and account for C in the Atlantic Coastal Plain.

Oak hammock Restoration on a Disturbed Site

Adjacent to Payne's Prairie (Gainesville, FL)

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Summer 2016 – Project Overview (Abstract)

In a case study preformed at the Wildlife Research Lab in Gainesville, an invasive removal and revegetation effort was begun due to the prevalence of exotic and invasive plant species located throughout the property. Attempts were made to preserve natives while spraying herbicide mixtures, and to do so in partial plots. Mixtures for best application were determined, methods were decided on, and the study was begun by the summer of 2015. The effort being made was to allow native plant species to rebound in these partial plots through passive revegetation, active revegetation, and to continue monitoring and spraying the plots over time. The passive revegetation on the sprayed plots was met by seeding from the native plants in unsprayed portions, as well as those plants avoided in the sprayed portions. The final spraying was completed this summer in 2016, and passive revegetation has been recorded; along with each spray treatment. To help in the recovery of natives, active revegetation was utilized by planting donated natives from Payne's Prairie. Continued inspections and spot treatments were recorded, as well as methods of spraying. The outcome was promising, yet we must stay diligent in order to stay on top of the invasive removal. The project has been handed over to Payne's Prairie State Preserve staff and contractors to continue monitoring and treatment using the data presented from this effort. At the current time Ardisia, Tradescantia, Lantana, Chinaberry, and one Tallow have all been located, mapped, and treated on our 7 acre compound.

Distributed wastewater treatment plants – A sustainable and economical phosphorus source through struvite recovery

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Soil and Water Sciences Department

Phosphorus (P) is a limited natural resource. Municipal wastewater treatment plants (WWTPs) are accessible sources of renewable P through the formation of struvite ($MgNH_4PO_4 \cdot 6H_2O$). Total P loads to WWTPs can range from 2.1 to 4.1 g/capita/day with inflow concentrations of approximately 3.7 to 11 mg/L. Struvite recovery from four distributed WWTPs in North Florida with treatment capacities from 371 to 2650 m^3/day and incoming P loads from 2 to 14 kg/day was investigated. Struvite formed by adjusting the pH of wastewater filtrate from an average of 7.0 to 8.5 using a base (NaOH). Air sparging was investigated as an efficient and economical alternative to using base. Beaker experiments were used to compare struvite recovery using base additions with stirring versus air sparging. Sparging was achieved with an air diffuser (bubble size 1-3 mm). The pH in the stirred beaker (no sparging) was adjusted by the addition of 5 N NaOH. Struvite formation in the air-sparged treatment showed a 1-22% increase in yield from the wastewater filtrate in the stirred beaker treatment and an increase in purity from 12 to 45%. Assuming an average struvite formation rate of 212 g/m^3 of wastewater, the combined distributed WWTPs in the United States are capable of producing 1.2 million metric tons of P as P_2O_5 per year. This would reduce the global demand on phosphate mining by 3%.

EVOLUTION OF LEGUME-RHIZOBIA MUTUALISM AFTER 18 YEARS OF ELEVATED CO_2 AND N AVAILABILITY

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Legume species maintain symbiotic relationships with rhizobial bacteria present in the soil to gain access to atmospheric nitrogen. However, this mutualism may be influenced by fluctuations in atmospheric carbon dioxide and soil N availability: increased CO_2 is predicted to increase the density of rhizobia in the soil and the benefit they provide to legumes, while increased N is predicted to decrease rhizobial densities and benefits provided. Additionally, it remains unclear whether this response is evolved or an example of phenotypic plasticity. By exposing legumes and their associated rhizobial bacteria to chronically elevated CO_2 and N conditions for 18 years, we were able to examine how the mutualism was altered. We worked within the BioCON experiment at the Cedar Creek Ecosystem Science Reserve in Minnesota, USA to expose *Lespedeza capitata* seedlings to all combinations of ambient or increased CO_2 and/or N. We collected soil from established monocultures of *L. capitata* that had been grown under one of the four treatments CO_2xN treatments since 1997. We then grew *L. capitata* seedlings in pots inoculated with each soil type under all possible CO_2 and N conditions (*i.e.*, both ancestral and novel conditions). By counting the nodules formed and measuring aboveground and belowground biomass, we can comment on current theoretical predictions and suggest trends for legume-rhizobia relationships under future global change conditions.

BioCON: Biodiversity, CO_2, and Nitrogen; **CO_2**: atmospheric carbon dioxide; **N**: nitrogen

Analysis of microbial communities and N cycling associated with groundwater discharge in the Yucatan Peninsula.

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The activities of groundwater microbial communities control much of the geochemical cycling that impacts water quality associated with submarine groundwater discharge (SGD). An understanding of the structures of those communities would yield insight into the controls on biogeochemical cycles in these environments. The objectives of this study were to characterize microbial communities by way of analysis of 16S rRNA gene amplicon sequences and specific genes involved in the nitrogen cycle in water samples collected from various locations in a hydrologic system of the Yucatan Peninsula. We studied several sites with potential hydrologic connections, including a stratified cenote; a nearshore spring (Pargos); and water above the spring (lagoon) at high and low tides and two seasons (wet and dry). The structures of the microbial communities varied more spatially than temporally, and hydrological connections were responsible for the similarity of the microbial communities between Pargos and C7B. Spring reversal quickly shifted the structures of the communities in submarine groundwater from being more similar to C7B at low tide to more similar to the lagoon at high tide. N cycling was controlled by weakly uncoupled nitrification-denitrification processes in C7B and strongly coupled nitrification-denitrification process in Pargos. The potential N-nutrient output to the ocean via SGD will likely be reduced due to enrichment of most N cycling genes during the wet season compared with dry season, especially with lower discharge and higher N cycling genes during high tides. These results may have significant implications regarding water quality of both the lagoon and groundwater with increasing sea level rise.

Land Application of Lignocellulosic Residual Wastes: Effects on Soil Biogeochemical Properties

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The production of bioethanol, using lignocellulosic feedstock, can result in the co-production of high-nutrient quality bioenergy residues that can be used as a soil amendment. However, there is limited knowledge on the effects of applying these residues on soil biogeochemical properties and soil quality. The main objective of this research is to determine the effects of the land application of bioenergy residues on soil biogeochemical processes, such as C cycling, including microbial respiration, enzyme activities and nutrient content and release. Traditional nutrient extraction techniques and ^{13}C nuclear magnetic resonance (^{13}C NMR) spectroscopy were used to characterize the following six bioenergy residues: wet cake, raw sugarcane bagasse, biosolid, compost, anaerobic digestate, and vermicompost. Among these, bagasse (feedstock for biofuel plant) and wet cake (biofuel plant residue) were found to have the highest C:N ratios, % loss on ignition (LOI), and plant available ammonium (wet cake only). Laboratory incubation studies with residues showed higher decomposition rates for wet cake and bagasse treatments than other residues. Residue-amended soils showed stimulation of microbial activity, organic N mineralization rates, and the release of plant available nutrients. In general, our results suggest bioenergy residues can be land applied in lieu of synthetic fertilizers to provide adequate plant available nutrients.

EFFECTS OF VARYING RATES OF P AND K FERTILIZER ON SANDY SOIL AND PEANUT PRODUCTION

Land, A., R. Mylavarapu, G. Means, R. Gautam, F. Bortolozo

ABSTRACT

Over 4 million metric tons of peanuts annually are produced in the US, mostly in the southeast, and the economic value of peanut production in Florida was $145 million in 2014. Both phosphorus (P) and potassium (K) are key macronutrients for proper growth of peanut plants. However, sandy soils in Florida can potentially result in leaching of these nutrients. A field demonstration was set up on a 400-acre Spanish-runner peanut farm in Suwannee county to determine the optimum P and K requirements of peanuts for optimum yields while minimizing nutrient leaching. Four rates of P and K combinations were applied both pre- and post-emergence to the plots replicated four times. Tissue and soil samples (6-inches depth) were collected from each plot at 30 and 60 days following planting into the soil and analyzed for P and K concentrations. Results showed that there was no significant difference in the 30-day samplings of tissue and soil samples between the control and treatment groups. At 60-days, the leaf samples in control had significantly less K than the plots that received any K. No differences in P concentrations were measured. This study is ongoing and concentrations of P and K in soil and leaf tissue in relation to the yields will be evaluated at harvest.

P= phosphorus
K=potassium

Leah LaPlaca
Poster Abstract

Anatomical Responses of *V. Americana & S. kurziana* to Water Column Nitrate Concentrations and Sediment Type

Current observations of water quality in groundwater discharge from springs in Florida show anthropogenic enrichment of nitrate plus nitrite (NO3-N). While the indirect effects of nitrogen (N) enrichment on aquatic macrophytes, *V. Americana & S. kurziana*, are well-documented (i.e., algal productivity resulting in shading of macrophytes), there is considerably less information available concerning direct anatomical responses of NO3-N and sediment type on macrophyte growth. Anatomical responses of *V. Americana & S. kurziana* to water column NO3-N concentrations and sediment type were quantified using mesocosm experiments. Nitrate reductase activity (NRA) increased with water column concentrations with the highest activity measured in root fibers of all NO3-N concentrations indicating the importance of roots in uptake and assimilation of nitrogen. Aerenchyma and N-partitioning within SAV tissue was unaffected by water column NO3-N at the investigated concentrations. Root to shoot biomass ratios increased in *V. Americana* with nitrate levels, while root: shoot ratios decreased in *S. kurziana* for both sediment types. *V. Americana* also increased starch concentration, while *S. kurziana* starch content remained constant. *S. kurziana* cultivated on organic sediment also increased asexual rhizome reproduction. Water column nitrate concentrations and sediment characteristic effect anatomical responses of SAV and can be important factors in management and restoration of Florida springs.

Dissolved Organic Nitrogen in Runoff/Surface Water from Agricultural Fields

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Dissolved organic nitrogen (DON), along with inorganic nitrogen can be a significant part of the reactive N in aquatic ecosystems and can lead to eutrophication and harmful algal blooms. One-year observation was coupled with Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR-MS) to identify molecular composition of DON in the agriculture storm runoff water from citrus grove and pasture. More than 3000 N-bearing organic formulas were identified by FT-ICR-MS in the storm runoff water. These molecular formulas represented a wide range of biomolecules such as lipids, proteins, amino sugars, lignin, tannins, unsaturated H/Cs, condensed H/Cs and carbohydrates. Most of them were lignin. During the waterway, molecular weight increased and aromaticity index decreased. From the source to the discharge point, 1447 unique N-bearing were identified, and the median molecular weight increased. Molecular weight and aromaticity index also varied with seasons. This work implies that the storm runoff water from agriculture production system has the potential to influence biogeochemical processes in downstream water bodies.

Simulating Everglades carbon fluxes and GHG Emission Under Varying Hydrology Parameterization in the Community Land Model

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Wetlands are an important player for the global carbon cycle. Carbon flux in wetland distinguishes from that in other ecosystems because of limited oxygen supply under inundation causes anoxic conditions soils. Here, we use the community land model (CLM 4.5) to quantify effects of seasonal dynamics of soil hydrology affects CO_2 and methane emission for a subtropical wetland in Florida's Everglades.

One of the big challenges in applying CLM is to create conditions in the model that lead to the establishment of a wetland within CLM at our South Florida location. In order to achieve this, we firstly created a surface map to represent the vegetation community and the characteristics of Everglades soil. In order to obtain realistic water table levels, we allowed for lateral water transport in that area and reparametrized hydrologic conductivity. We performed several simulations with CLM that address the variation of water table in the soil layers and to elevated temperature to evaluate carbon fluxes and GHG emission in the study area. Our results suggest the variation on water table depth has significant influence on the carbon cycle in the Everglades. Deeper water table results in a higher CO_2 but lower CH_4 emission, partly due to the CH_4 oxidization in shallow layers and the rapid decomposition of organic carbon. In the wet season, more CH_4 is produced when the water table is shallower. Slightly elevated temperature causes a water loss through evapotranspiration which deepens the water table. This induces enhanced carbon loss, which is partly offset by the enhanced productivity of vegetation. Overall, our work can serve as a base to address GHG emission based on the hydrological dynamics of a vegetated wetland in Florida and subtropical wetlands in general. The adapted model also provides a platform to further investigate biogeochemical cycles in response to climate scenarios and in response to different Everglades restoration strategies.

Key words: wetland hydrology, GHG emission, community land model

Hyphenated hydrology: Multidisciplinary evolution of water resource science

K.L. McCurley and J. W. Jawitz

Hydrology has advanced considerably as a scientific discipline since its recognized inception in the mid-20th century. While hydrology may have evolved from the singular viewpoint of a more rigid physical or engineering science, modern water resource related questions have forced adaptation toward a deliberate interdisciplinary context. Over the past few decades, many of the eventual manifestations of this evolution were foreseen by prominent expert hydrologists, though their narrative descriptions lacked substantial quantification. This study addresses that gap by directly measuring and inspecting the words that hydrologists use to define and describe their research endeavors. We analyzed 16,591 journal article titles from 1965-2015 in Water Resources Research, through which the scientific dialogue and its time-sensitive progression emerge. Word frequency and term concurrence reveal the dynamic timing of the lateral movement of hydrology across multiple disciplines and a deepening of scientific discourse with respect to traditional hydrologic questions. This study concludes that formerly exotic disciplines are increasingly modifying hydrology, prompting new insights as well as inspiring unconventional perspectives on old questions.

Vegetation Response and Elevation Change in a Perturbed Hydrologic Regime: The Subsidy-Stress Gradient in a Peat-Based Floodplain Marsh

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ABSTRACT

Wetland restoration based on environmental criteria can be at odds with hydrologic conditions resulting from flood control strategies in the watershed. Increased hydroperiods have been shown to decrease cover of emergent species and create a gradient that alters vegetative community structure; while decreased hydroperiods result in upland species encroachment and peat loss by subsidence. Prior to levee construction in 1991, FDMCA was bordered by an incomplete agricultural levee that allowed unregulated drainage of the FDMCA to the surrounding flow-way. After levee construction, inundation frequencies increased by up to 15% compared to historical averages. As a result, herbaceous marsh vegetative community die-off with a shift to an open slough community as well as increased soil accretion rates were expected. To determine the implications of levee construction in this peat marsh, we monitored the vegetative community structure, soil characteristics, and elevation in the FDMCA before and after levee construction. Results indicate that the perturbed hydrologic regime in FDCMA elicited a vegetation response that maximized belowground productivity, resulting in a rise in surface elevation of approximately 1.1 cm yr^{-1}. This rate is 40% greater than accumulation rates measured before management in FDMCA. Considering Odum's perturbation theory on stress-gradients, the altered hydroperiods did not result in a stress to vegetative communities; rather, they provided a subsidy that resulted in increased water storage without a loss in function. As such, we suggest that post-project monitoring is vital to successfully understanding ecosystem response.

List of abbreviations used
cm yr^{-1}: centimeters per year
FDMCA: Fort Drum Marsh Conservation Are

Title: Prototype Development of a New Soil Index Using Econometrics Method: Data Envelopment Analysis

Author: Katsutoshi Mizuta, Sabine Grunwald, Wendell P. Cropper, Wonsuk Lee, Gustavo M. Vasques, Michelle A. Phillips

Presentation Type: Poster (http://soils.ifas.ufl.edu/research/research-forum/2016-sws-research-forum/)

Abstract:

Index studies in soil science have been discussed and implemented to quantify conceptual assessments of the quality or health of soils. ordination techniques have mostly been used in the literature. However, these approaches do not meet with any of the axiomatic features of an ideal, scientific rigorous indication system. Our approach based on econometric theory using Data Envelopment Analysis (DEA) does meet with those criteria. The DEA has not been explored yet in soil science. Therefore, we constructed a prototype DEA to evaluate its applicability to assess the soil carbon sequestration (SCseq) Capability Index (SCI) based on the SCseq rate and climatic, biotic, and soil hydrologic factors in Florida. A total of 196 collocated samples were collected from the topsoil (0-20 cm) from both current (2008-2009) and legacy dataset (1965-1996) in order to compute the SCseq rate. The SCI scores allowed comparing the spatially-explicit efficiency of carbon accretion as they relate with environmental conditions, such as climate. The SCI scores ranged between 1.00 and 1.09, with values close to 1 expressing high capability for carbon storage. The SCI score infers on the optimum level of SCseq capability based on a given set of relevant environmental parameters. Thus, carbon capability values provide more information to guide management and optimize the ecosystem function compared to traditional soil carbon assessment. Additional benefits of using the DEA analysis entail its

transferability to other geographic regions providing a standardized indication system to assess soil carbon capability and many other soil ecosystem functions. (247/250)

NITROGEN FORMS IN GRADIENT FROM FRESHWATER TO ESTUARINE ECOSYSTEM: LONGITUDINAL DISTRIBUTION, BIOAVAILABILITY AND SOURCE CHARACTERIZATION STUDIES

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Contribution of nitrogen (N) to nutrient enrichment and eutrophication in water bodies that causes harmful algal blooms, hypoxia and loss of essential habitat for aquatic organism has been recognized. Research on the bioavailability of organic N from freshwater to estuaries is needed because organic N forms are dominant in most water bodies. Our objectives were to (1) determine the longitudinal distribution of inorganic and organic N forms and (2) determine dissolved organic nitrogen (DON) bioavailability and (3) identify sources of nitrate (NO_3-N) in freshwater and estuarine ecosystem. Our methods included monthly water sampling (Dec 2015-May 2016) from 13 sites along a longitudinal gradient from freshwater (10 sites) to estuarine (3 sites) ecosystem. All samples were analyzed for various N forms [ammonium (NH_4-N), nitrate (NO_x-N), total nitrogen (TN), total dissolved nitrogen (TDN), DON and particulate organic nitrogen (PON)]. Bioassay experiments were conducted for 5 days to determine the bioavailability of DON. Mean concentrations of total N in freshwater sites were 0.5–1.2 mg/L and estuarine sites were 0.5–0.6 mg/L; these were lower than EPA numeric criteria for freshwater (1.65 mg/L) and estuarine (1.125 mg/L) ecosystems. Organic N forms were dominant at all sampling sites (DON: 64%, PON: 22%) as compared to inorganic N forms (NO_x-N: 7%, NH_4-N: 7%). The bioavailability of DON ranged from 13% to 65% across sites, with highest bioavailability in the estuarine sites. Data obtained from stable isotope showed that NO_3-N in urban waters was influenced by mixing of multiple sources and biotic processes (i.e. nitrification and denitrification). Although the estuarine ecosystem had low DIN (<15% TN), the higher bioavailability of DON in estuarine ecosystem suggests that algae and bacteria will be able to consume DON to meet N requirement and thus lead to water quality degradation in the urban coastal ecosystem.

Title: Revisiting Traditional Sedimentation Techniques and Redefining Soil Texture with Laser Diffraction Technology

Authors: Pachon, J.C. and A.R. Bacon

Quantifying soil texture is critical to field and model based investigations on Earth's surface aimed at understanding soil properties and processes as well as how these respond to natural and anthropogenic forces. Traditional methods to estimate soil texture rely on sedimentation and Stoke's Law to divide the soil particle distribution into three distinct size classes; sand (2,000 - 50 μm), silt (50 to 2 μm), and clay (< 2 μm). Information regarding the relative abundance of these three size classes has given rise to the soil textural triangle, various soil classifications, and has proven to be a fundamental metric for essentially every sub-discipline of soil science. Recent advances in laser diffraction technology have opened the door to better understanding and quantification of soil texture. Laser diffraction methods are simple, rapid (about six minutes per sample), need a small sample size (1 mg or less), and have high reproducibility. Most importantly, soil texture estimates obtained by laser diffraction provide a continuous particle size distribution across a broad range (0.017 - 2 μm). Here, we layout the assumptions, strengths, and pitfalls of traditional and laser diffraction based estimates of soil texture. We also present preliminary laser diffraction data from the Environmental Pedology and Land Use Laboratory to highlight the potential for this emerging technology to redefine physical analyses of soil.

A survey of nitrogen fixation potential in a subtropical estuary (Indian River Lagoon, FL).

Joshua R. Papacek, Edward J. Phlips, Margaret A. Lasi & Patrick W. Inglett

Eutrophication and increasing harmful algae blooms in the Indian River Lagoon (IRL), a subtropical estuary in Florida, has led to an investigation of potential nutrient sources including N_2 fixation in the water-column. This research aims to address the seasonal and spatial importance of this process in supplying new N to the IRL. Water-column collections occurred on a near bi-monthly basis and N_2 fixation activity was measured via the acetylene reduction assay (ARA) technique under light and dark conditions. Fall and winter rates remained low (< 0.01 ng N/ml/hr), but summer rates were significantly higher for both dark and light treatments on a per volume basis. $^{15}N_2$ incubations of samples collected in August 2015 confirmed the high ARA rates observed. N_2 fixation was not detected by ARA during a brown-tide bloom that began in the fall of 2015. Two-way ANOVA showed a significant temporal effect ($p<0.001$) as well as a slightly less significant interaction between month and treatment ($p<0.1$). These results may suggest higher heterotrophic contributions over winter months while photosynthetic N_2 fixers were most active in summer. Tends in N_2 fixation loosely corresponded with increasing biomass P in the lagoon indicating that P availability may control N_2 fixation at certain times of the year. However, traditional nutrient ratios (e.g. N:P) were not a significant predictor of N_2 fixation activity. Overall, results from this research indicate that N_2 fixation is a potentially important process supplying new N to intiate and sustain algal blooms in the IRL.

Open-pond Cultivation of Microalgal Polycultures on Landfill Leachate

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Utilizing waste effluent for the production of renewable fuel sources not only reduces our dependence on fossil fuels but also provides an opportunity for environmental bioremediation. Liquid that permeates through layers of municipal waste in landfills (landfill leachate) is a waste effluent that requires collection and costly treatment. Landfill leachate (LL) has sufficient nutrients for microalgae cultivation, making it a viable growth medium for algae used in biofuel production. Total ammonia nitrogen (TAN) is typically very high in LL, which hinders algal growth, prompting cultivation in diluted LL or determining other favorable conditions for growth. The research objective was to grow indigenous microalgae outdoors in a 100-L raceway pond in non-diluted LL. Mature leachate was collected from a closed landfill and characterized for pH, conductivity, alkalinity, solids concentrations and chemical oxygen demand. The leachate was inoculated with a microalgal polyculture and monitored daily for pH, growth (optical density) and TAN. Carbon dioxide was added continuously to the pond through a diffuser for pH control. Microscopy was used to evaluate the biodiversity of the microalgal polyculture before and after the trial. Results showed that algal biomass increased in 100% LL over the 11-day period. CO_2 was an effective means of maintaining a neutral pH, which favored the presence of ionized ammonia (NH_4^+) rather than unionized, free ammonia (NH_3) that can disrupt algal cellular metabolism. Certain algae strains were more tolerant than others. The overall reduction of TAN from 800 to 5 ppm demonstrates the potential of microalgae for bioremediation of LL.

Karst Depression Analysis and Landscape Pattern in Big Cypress National Park

Regular patterning in landscapes is thought to be the result of positive and negative feedbacks occurring at different spatial scales. Previous studies have suggested regular patterning of depressions to be a feature of the low relief karst topography of Big Cypress in South Florida. Long range inhibition of patch expansion is expected to limit patch sizes and therefore size class distributions of the wetland depressions on this landscape are not expected to follow power law scaling. In this study we aim to use patch size analyses to make inferences about patterning. High Resolution LiDAR data was collected for our study area and processed using ARCMAP, Patches were then delineated using depression identification methods. Size class distributions of the selected depressions were then analyzed by way of inverse cumulative distributions of depression sizes. Size class analysis of depressions indicates an exponential distribution in wetland depression sizes. A lack of power law scaling for the patches on the landscape would seem to indicate that the growth of depressions is limited by feedbacks operating a long ranges and support inferences of regular patterning. Findings of regular patterning on this landscape aid us in our conceptual understanding of the formation of this landscape and support the idea that the formation of this landscape was biotically mediated.

Authors: Carlos Quintero, Matthew Cohen

INFLUENCE OF CARBON LABILITY AND FLOODING TREATMENT IN POTENTIAL OXIDATION OF HISTOSOLS IN THE EVERGLADES AGRICULTURAL AREA

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Drainage of the EAA soils has resulted in soil subsidence. Subsidence rates have been reduced compared to previous rates. Increases in mineral content, recalcitrant carbon, and higher water tables due to the use of best management practices are considered as possible causes for these reduction. The purpose of this research is to determine how the soil lability and water management affect subsidence rates. To determine the influence of these factors in soil subsidence the oxidation rates (CO_2 efflux) of shallow and deeper EAA soils exposed to four water management treatments are being evaluated. Additionally, measurements of NO_3-N, NH_4-N, SON, and DOC on leachates are being performed. Preliminary results indicate that the soils exposed to 2 days flooding – 12 days draining flooding cycles have the highest CO_2 efflux rates (between 52 and 157 mg of CO_2 C m^{-2} h^{-1}) of all water treatments. The NH_4-N in leachates is highest in flooded soils (0.46 to 0.86 mg L^{-1}) compared to drained soils, whereas NO_3-N shows the opposite trend with concentrations as high as 395 mg L^{-1} in shallow drained soils. The SON and DOC have similar trends with highest concentrations in the drained soils. In the case of DOC deeper soils appear to have higher concentrations (54 - 74 mg C L^{-1}) compared to shallow soils (35- 39 mg C L^{-1}). These preliminary results indicate that cycles of flooding might not be beneficial for soil conservation, and water management is of great importance controlling C and N cycling in subsiding histosols.

Abbreviations: (EAA) Everglades Agricultural Area, (SON) soluble organic nitrogen, (DOC) dissolved organic carbon.

Data mining reveals relationships between soil carbon and environmental factors at Tier 2 sites

C. Wade Ross, Sabine Grunwald, Jason Vogel, Allan Bacon, Eric J. Jokela, Rosvel Bracho-Garrilo, Madison Akers, Joshua Cucinella, Andy Laviner, Daniel Markewitz, Tom Fox, Tim Martin

Soils of the US Southeast are estimated to store between 8.9 and 51.2 Pg carbon, accounting for more than 1/3 of the total soil carbon storage for the conterminous US when using the median value. This large range is attributed to the highly variable nature of soil as well as difficulties associated with applying accurate, yet economically feasible methods to capture this variance across large geographic regions. Additionally, many of the current estimates were derived from highly aggregated datasets, such as SSURGO, with limited sample support.

The objectives of this study were to i) identify relationships between soil carbon, soil properties, and relevant environmental covariates in forested ecosystems of the US Southeast, ii) improve current estimates of soil carbon stocks to 1m depth and iii) assess the models ability to predict soil carbon without using any measured soil data.

To achieve these objectives, we applied data mining techniques in conjunction with machine learning (Random Forest) to a large suite of environmental covariates (N ~ 600) across the US Southeast. Environmental covariates with high prediction power include eco-regions, Major Land Resource Areas (MLRA), geology, biomass, climate data, and soil properties, among others. The best models used a combination of measured soil properties and a wide variety of publicly available data, resulting in an adjusted R^2 of 0.93 and 0.61 for training and validation sets, respectively. Random Forest also performed well when using only ancillary data, and resulted in an adjusted R^2 of 0.93 and 0.42 for training and validation datasets, respectively.

Bioenergy Production from Sheep and Goat Manure

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Sheep and goats require less land and feed than larger livestock, making them less expensive to maintain. Their manure is in a pellet form that can easily be collected and utilized for bioenergy and biofertilizer. Methanogenic bacteria from the animals' ruminant digestive system are present in the manure. Thus, sheep and goat manure are ideally suited feedstocks for anaerobic digestion to recover renewable energy (*i.e.* methane). Sheep and goat manure are also rich in macronutrients including nitrogen and phosphorus, as well as micronutrients including iron, zinc and copper. Following digestion, these nutrients remain in the effluent and can be used for soil amendment. The objectives of this study were to characterize each manure type and determine their ultimate methane yields. Fresh sheep and goat manure were collected locally and characterized for pH, conductivity, alkalinity, dry matter (DM), organic matter (OM), and chemical oxygen demand (COD). The sheep manure had a pH slightly above neutral (8.10 ± 0.07) and thus would be beneficial for improving soil pH. Methane index potential batch assays were conducted at 35°C for 40 days, in triplicate. Goat manure had higher DM and OM contents, resulting in a higher methane yield from goat (7.1 L CH_4/lb) versus sheep (5.1 L CH_4/lb) manure on a fresh weight basis. However, both types of manure were determined to be viable for methane production. Nutrient characterization in the post-digestion effluent is recommended to evaluate its potential biofertilizer value.

Evaluation of organic carbon accumulation on a mangrove spoil island

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Long-term monitoring of coastal reclamation projects are required to determine sustainability and stability of reclaimed ecosystems. Organic carbon accretion, a valuable ecosystem service, is a significant indicator of healthy ecosystem function. SL-15, a spoil island in the Indian River Lagoon was restored to mangrove and seagrass habitat in 2005. Vegetation abundance and soil biogeochemical characteristics were measured at time =0, one year, and ten years to assess organic carbon accretion in both seagrass and mangrove areas. Sediment cores were collected in a set of four plots, located on the SL-15 mangrove island and analyzed for % total organic carbon, microbial biomass carbon, and extractable organic carbon. Vegetation was assessed by surveying 16 plots created within the island and measuring dbh, tree height, and tree canopy to calculate carbon stocks within the vegetative biomass. Organic carbon within the sediment was much lower than that seen in vegetation at the 10 year time point. Carbon trapped in coastal systems, such as SL-15, is extremely important to blue carbon stocks and buffering of climate change.

Title: Risks from Biosolids-borne Ciprofloxacin and Azithromycin

Authors: Harman Sidhu and George O'Connor

Abstract: Concerns about biosolids-borne trace organic compounds (TOrCs) threaten the viability and sustainability of land application of biosolids. Numerous data gaps, prompted the USEPA to identify azithromycin (AZ) and ciprofloxacin (CIP) amongst the high priority compounds for the risk assessment of biosolids-borne TOrCs. Based on the central hypothesis that the limited bioaccessibility of strongly sorbed biosolids-borne CIP and AZ minimizes risks to humans and/or environmental health, a scientifically sound integrated risk assessment is underway. The risk assessment encompasses generating (and/or gathering) high quality data on the fate, exposure, and toxicity of the target TOrCs through literature searches, from greenhouse/lab studies, and/or field samples. An emphasis is placed on data generated in environmentally relevant biosolids-soil matrices, with realistic loading rates, and under real-world scenarios. A critical review of literature identified major data gaps in the bioavailability (sorption/desorption, terrestrial bioaccumulation factors, biouptake), degradation (biodegradation and hydrolysis of AZ), and toxicity (human and terrestrial systems) benchmarks of the target TOrCs. Using data from literature, peers (human toxicity), and that being generated on sorption-desorption of, biotoxicity from and uptake of (plants and earthworm), degradation of, and microbial response to the target TOrCs; an integrated risk assessment will be accomplished using USEPA's biosolids core risk assessment model (BCRAM) Screening Tool. The preliminary data on plant toxicity and sorption-desorption kinetics studies show support towards the central hypothesis. However, various missing data gaps (especially the microbial response to the target TOrCs) needs to be filled for a sound risk assessment.

Carbon Stocks in a Shifting Ecosystem; Climate Induced Migration of Mangroves into Salt Marsh

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Across the globe, climate change has driven modifications in the structure, function and distribution of many ecological communities. In parts of the southeastern United States, decreased incidence of freeze events have resulted in the poleward range expansion of mangroves at the expense of salt marsh habitat. The replacement of coastal wetland foundation species will likely have substantial functional and structural repercussions, ranging from important biota effects, to ecosystem stability, to biogeochemical processes. Understanding the long term viability of these habitats and their carbon (C) pools depends on habitat response to shifting regimes. We documented ecosystem C stocks and investigated aboveground decomposition and soil respiration along the Atlantic coast of Florida. The 342 km latitudinal gradient studied spans pure mangrove habitat, the salt marsh - mangrove ecotone, and pure salt marsh habitat and gives us an exceptional opportunity to document and investigate composition, structure and ecosystem function as mangroves transgress into salt marsh habitat. Habitat C pools are constrained by temporal and spatial differences along the latitudinal gradient. Modification of ecosystem services depends largely on the balance between organic matter production and decay, and an alteration in foundation species distribution will likely alter productivity and ultimately the C dynamics of these important systems.

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Student Compost Cooperative – Promoting Soil Health

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The Student Compost Cooperative (SCC) is a cross-disciplinary outreach program established by Dr. Ann Wilkie (Soil and Water Sciences Department, UF-IFAS) that fosters sustainability and nutrient upcycling through composting and sustainable gardening. The SCC hosts demonstrations and hands-on activities, promotes collaboration among other on-campus organizations, and seeks to popularize sustainability and composting through social media. The SCC also provides free garden plots for students that lack access to adequate space, while encouraging them to compost their food waste and use the finished product for their own organic gardens. Composting is a biological, exothermic process in which organic wastes are decomposed into a nutritious soil amendment by macro- and microorganisms. Macroorganisms are the physical decomposers that grind the material into smaller pieces, while the microorganisms convert organic matter into humus and break down the nutrients into a bioavailable form where they can be assimilated into plant matter. Students learn to accelerate this process through appropriate nutrient ratios of carbon (leaves, twigs, cardboard) to nitrogen (fruit and vegetable waste, coffee grains, grass clippings). Turning the pile improves oxygen transfer and provides more surface area contact for the microbes. The advantages of composting are substantial, from the reduction of commercial fertilizer use, to improving soil health, and preventing nutrient leaching. The SCC organizes workshops and interactive field days using social media to encourage participation. All UF students, faculty and staff are invited to participate in the SCC to make this campus a more sustainable and interactive community of collective composters.