

Sensitivity Analysis Reveals Critical Factors that Affect Wetland Methane Emissions using Soil Biogeochemistry Model

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 for tropical and subtropical forests following the approaches used in more complex global biogeochemical emission models (LPJWhyMe and CLM4Me). The model was designed to replace model formulations with data streams for 2 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 using remote sensing data for soil moisture and plant productivity. Here, we present results from a global sensitivity analysis of the model order to determine which parameters and processes contribute to the model's uncertainty of methane emissions. Results show that parameters related to water table behavior, carbon input (in form of plant productivity) and rooting depth affect simulated methane emissions the most.

ENZYME ACTIVITY RESPONSES TO FLOWING CONDITIONS IN THE EVERGLADES STORMWATER TREATMENT AREAS

Authors: Baker, S., P.W. Inglett, and K.S. Inglett

In constructed wetlands like the Everglades Stormwater Treatment Areas (STAs), microbial processes play a key role in nutrient removal. Specifically, extracellular enzyme production regulates organic decomposition, nutrient mineralization, and indicate overall nutrient limitation. Hydrologic flow and its management directly effects nutrient distribution and loading, which likely alters microbial functions such as enzymatic activity; however, there are few studies that assess the effect of flow on enzyme activities. In this study, enzymes for P (phosphomonoesterase, APA and phosphodiesterase, BisP), C (β -glucosidase, BG), and N (Leucine aminopeptidase, LAP and β -N-acetylglucosaminidase, NAG) were analyzed at inflow, midflow, and outflow stations of STA 2 Cell 3 during stagnant and flowing conditions. Analysis of variance (ANOVA) results indicated that the main effects of flow were significant for carbon, nitrogen, and phosphorus related enzymes on a microbial and dry weight basis, N:P activities, and microbial biomass carbon and nitrogen ($p < 0.05$). In addition, a stronger effect of C:N and C:P activities were evident in flow and site ($p < 0.0001$). Canonical correlation analysis measured the contribution of variability in flowing and stagnant conditions within fifteen factors among the inflow, midflow, and outflow. These results suggest that C:P, N:P, and P related enzymes were the primary driving factors and outflow sites were significantly different among flowing and stagnant conditions. Future research will focus on the different rates (designated low, moderate, and high hydraulic loading rate) of flow in response to nutrient availability and stoichiometry in the water column.

Application of Aquatic Vegetation as a Bio-filter for Phosphorous Reduction from Farm Canals

Authors: Jay Capasso, Jehangir Bhadha, Allan Bacon, Raju Khatiwada, Mark Clark, Samira Daroub, and Timothy Lang

Phosphorous (P) loads from anthropogenic sources such as intensive farming practices can increase eutrophication and affect water quality. We hypothesize that biological uptake of P by aquatic vegetation can be used as a treatment technology to reduce P loads exiting agricultural fields in surface waters. This study will examine plant P-uptake by aquatic vegetation as water is circulated through four treatment ditches using battery operated solar powered hydraulic pumps. These hydraulic pumps situated at the inflow locations of the treatment ditches influence water flow and the distribution of sediment particles. A Laser Diffraction Size Analyzer was used to determine sediment particle size. Significant differences ($P < 0.02$) were observed in the median particle size between sediments collected in the inflow and outflow locations of the treatment ditches. Coarser textured particles ($137 \pm 7 \mu\text{m}$) were observed in the inflow locations and finer textured particles ($86 \pm 10 \mu\text{m}$) were observed in the outflow locations. Water circulation through the ditches can cause coarser particles to settle near the inflow and finer particles to settle near the outflow. Water and sediment are routinely sampled from inflow and outflow locations of the field ditch to examine how aquatic vegetation and flow change their physical and chemical characteristics. Preliminary water results show a reduction in total P, total dissolved P, and soluble reactive P in the outflow locations compared to the inflow locations. P fractionation experiments using modified Hedley et al. and ^{31}P -NMR spectroscopy methods are being conducted to investigate the role of organic particle size in P-speciation.

Phosphorus association and release from biosolids and corresponding biochars

Andressa M. Freitas, Vimala D. Nair, Willie Harris

Biosolids, the byproducts of wastewater treatment, have been suggested as a valuable soil amendment. When applied to the soil, these materials enable nutrient recycling while providing a solution for waste management. However, the nutrients could be detrimental to the environment if their release exceeds the soil's capacity to retain them. Biosolids conversion to biochar, a material obtained by combustion in the absence (or low concentration) of oxygen, could convert nutrients to more stable forms, which ultimately could benefit the environment. Our objective was to evaluate phosphorus (P) associations and desorption from biosolids from various places (Florida, Chicago and Spain), as well as their corresponding biochars. Materials were assessed using solid-state and solution chemistry techniques along with desorption experiments to identify the mechanisms of P retention and release. X-ray diffraction (XRD) and scanning electron microscopy (SEM) analyses indicated contrasting compositions among biosolids, with variations that related to processing and origin. Most of the biochar samples showed Ca- and Mg- P associations. The conversion of biosolids into biochar modified the mineralogy of some materials due to the presence of thermally unstable minerals (e.g., struvite). Chemical analyses such as water soluble P, pH, Mehlich 3-extractable P and other elements, total carbon, and total Kjeldahl nitrogen confirmed differences between biosolids and their corresponding biochars. Data suggest that biosolids from different locations, as well as their corresponding biochars, would differ markedly in nutrient release behavior and in the level of environmental risk they would pose if land applied.

Mental models of soil management for food security in peri-urban India.

Claire N. Friedrichsen, Samira H. Daroub, Martha C. Monroe, John R. Stepp, and Suhas P. Wani

Despite a huge invest in agricultural development during the green revolution; India is still a food insecure nation. During the green revolution agricultural development strove for increased crop production without considering the more holistic food security. Sustainable soil management is necessary to provide sufficient quantity and quality of food to India. Scientists, extension agents and farmers have different perspectives of how soil health is related to food security. Understanding the stakeholders' perspectives is essential to limiting unintended consequences and improving extension communication. Our study uses qualitative interviews to construct mental models of soil health for food security to provide insight into stakeholders' perspectives. The study site is a peri-urban watershed, which is currently participating in the Integrated Farmer Participatory Watershed Model (IFPWM). The results of our study are stakeholders' mental models of soil health, soil nutrient management, soil sodicity and food security. Themes that arose from the stakeholders' mental model comparison include (1) there are different perceptions of problems or limitations in the watershed, (2) technology may not solve some perceived problems, (3) local farmers may not perceive some technologies to be feasible and (4) local knowledge may be a source of new technology. This research suggests the importance of including the fifth dimension of food security, cultural acceptability within food security technology development and dissemination.

Total and Bioaccessible Concentrations of PAHs in Florida Urban Soils

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Soil cleanup standards for contaminated soils can be based on either soil background concentrations or risk-based values. Mounting evidence suggests that understanding contaminant bioavailability in soils is necessary for accurate assessment of contaminant exposure to humans via oral ingestion pathway. Polycyclic aromatic hydrocarbons (PAHs) are a group of contaminants come from biogenic, petrogenic and pyrogenic sources in the environment. The objective of this study was to determine the total and bioaccessible concentrations and distributions of PAHs in Orlando and Tampa urban soils. The results showed the soils were dominated by high molecular weight (HMW) PAHs in both cities. Benzo(a)pyrene equivalent (BaP-EQ) concentrations in 60-63% samples were higher than the residential Florida soil cleanup target level (FSCTL) at 0.1 ppm and 20-25% samples were higher than commercial FSCTL at 0.7 ppm. Orlando soils had relatively higher bioaccessible PAHs and BaP-EQ concentrations than Tampa soils, with both cities having similar PAHs bioaccessibility of 0-93%. The bioaccessible BaP-EQ concentrations in both cities were under commercial FSCTL. HMW-PAHs had relative lower bioaccessibility than LMW-PAHs due to the hydrophobic characters. Based on molecular diagnostic ratios and PMF model, major sources of PAHs in both cities were similar, mainly coming from pyrogenic, traffic emissions, and biomass and coal combustion. Based on GIS maps, total PAHs concentrations in central business district and areas near high traffic roads were significantly higher than the other areas in both cities.

TITLE: Soil morphology reveals the different origins of podzolized carbon

Podzolization is a widespread and important component of soil formation and carbon cycling in the southeastern United States Coastal Plain. This process is studied extensively in relatively shallow Bh horizons (shallower than one-meter), where frequency and duration of near surface saturation exerts strong vertical control over near surface podzolized carbon (NSPC). Coastal Plain soils however can also contain deep podzolized carbon (DPC) well below a depth of one-meter, and often beyond the reach of traditional two-meter assessments. Although DPC is extensive, covering up to 3 million ha in the southeastern US Coastal Plain, the hydrologic processes that underpin its formation are uncertain. Here we reveal along a catena in north central Florida, with a gradient in near surface saturation, that DPC morphology contrasts that of NSPC, suggesting differences in the processes that stabilize shallow and deep podzolized C. Chroma above NSPC increases at a rate of one unit per 20 cm of depth, and NSPC value increases by one unit every 12 cm. While horizons containing NSPC tend to lighten with depth, horizons containing DPC darken with depth. Carbon concentration follows these morphologic indicators, decreasing by up to 1.3-fold in horizons with NSPC, and increasing by nearly 7-fold in horizons with DPC. Modifying how we describe horizons with podzolized carbon could facilitate a more comprehensive and accurate understanding of soil on the Coastal Plain landscape. A more complete understanding of the hydrologic processes that influence organic carbon stabilization in soils can guide land managers, earth scientists, and policy makers when deciding how to respond to changes in sea level, land use, and atmospheric CO₂ levels.

AUTHORS: Yaslin Gonzalez, Allan Bacon, Willie Harris

The Effect of Harvesting Frequency on Microalgal Cultures in Open Raceway Ponds

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Algae are a highly productive crop that can be utilized as a nutritional supplement or as a feedstock for bioenergy via anaerobic digestion. The major benefit of algal biomass is that it reproduces within hours rather than days or months. Many factors contribute to algal productivity including availability of light and nutrients, pH, temperature, algae species, and retention time. The objective of this study was to evaluate the effect of harvesting frequency on microalgal productivity. Microalgal polycultures were maintained in two 1000-L outdoor raceway ponds with periodic addition of nutrients, an on-demand supply of carbon dioxide for pH control and carbon addition, and removal of 50% of the biomass during regular harvest intervals. During the six-week experiment, the harvesting frequency was increased from two to three to four times per week in each pond. Representative samples were collected (in triplicate) during harvest and evaluated for pH, temperature, and total and volatile suspended solids (VSS). Predominant algae genera were identified using light microscopy. Algal productivity was calculated based on the accumulation of VSS over the specific algal growth period (i.e. time between harvests) and is expressed as gVSS/m²-day. The results indicate that when the harvesting frequencies were increased from 2 to 3 to 4 times per week, average productivity increased from 8.3 to 11.7 to 16.1 gVSS/m²-day in Pond A and from 9.0 to 13.3 to 16.3 gVSS/m²-day in Pond B. Thus, nearly twice as much biomass can be produced from microalgal ponds when harvesting frequencies are increased from 2 to 4 times per week.

Title: Sensitivity analysis of a wetland biogeochemistry model based on spiraling theory suggests internal nutrient cycling becomes an important factor to performance

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Biogeochemical models are essential tools for understanding the cycling of nutrients in constructed wetlands, including linking disparate data collected at specific locations and time. A global sensitivity analysis (GSA) was performed on our phosphorus spiraling model which tracks the transformation and transport of phosphorus (P) in the Everglades Stormwater Treatment Areas (STAs). This includes P in the water column, periphyton, macrophytes, litter (P in dead plant above- and below-ground biomass), floc, and recently accreted soil. A GSA identifies which inputs have the greatest influence on the model output by analyzing the distribution of variance with two indices (S_i : first-order sensitivity index and S_{Ti} : total effect index). The target output variable for the GSA was the annual outflow total P concentration in a STA after 17 years. We found that there is a strong sensitivity with the settling rate of P and soil parameters such as the P mineralization rate, strongly sorbed rate, and the maximum sorption capacity of recently accreted soils. Overall, our preliminary work that integrates over a long time of wetland operations suggests that internal soil processes are key for phosphorus retention in the STAs. Soil total phosphorus (TP) is a major source of uncertainty due to the lack of field data. These results suggest that to understand how internal loading influences phosphorus retention it is essential to collect soil data.

Abbreviations: global sensitivity analysis (GSA), phosphorus (P), stormwater treatment areas (STAs), total phosphorus (TP)

Agronomic and Environmental Impacts of Land Application of Biosolids on Bahiagrass Pastures in Florida

Yanyan Lu, Maria Lucia Silveira, George O'Connor, Joao M.B. Vendramini, John E. Erickson, and Yuncong Li

Biosolids represent an effective alternative source of nutrients for the production of perennial forage crops. Land application of biosolids to pastures also improves soil fertility conditions and often results in greater forage production and nutritive value. In addition, biosolids are obtained at little or no cost to farmers. However, long-term application of biosolids at rates based on crop N requirements results in P applications far in excess of crop requirements and subsequent soil P accumulation. Although excess soil P is not harmful to plants, off-site migration of P has been recognized as a major cause of fresh water impairment in Florida. Consequently, current legislation limits biosolids applications, particularly in Central and South Florida where most of the beef cattle industry is located. Biochar has a great potential to be used in combination with biosolids to improve nutrient use efficiency and thus, reduce N and P losses. The objective of this study was to evaluate the effects of biosolids and biochar application on soil, water quality, and forage responses. Treatments were: one class AA heat-dried pellets, two class B (aerobically and anaerobically digested) cake biosolids, and commercial fertilizer. Biosolids and fertilizer were applied either alone or in combination with biochar. Treatments were established in 2016 and forage, soil, water quality, and greenhouse gas emissions have been monitored during the 2 yrs. experimental period. We anticipate the results from this study will generate important science-based information regarding the benefits of land application of biosolids and biochar to pastures in Florida.

Kathryn McCurley and James Jawitz

Impacts of tropical land use change on the local hydrologic regime

Abstract

The coupled effects of world population growth along with climate change drive agricultural production, which manifests as tangible landscape alterations. Deforestation is one such land cover modification that influences the components of the hydrologic cycle. We investigated the effects of agricultural land expansion, resulting in deforestation, on the local hydroclimate, upon which agricultural production relies. Using global gridded rainfall and potential evapotranspiration data along with time series runoff data from the Global Runoff Data Centre, we approximated the parameter described in the Budyko framework in order to assign a value to catchments of varying degrees of forestation over time. We then analyzed the effects of land use change on the partitioning of rainfall into evapotranspiration and runoff. Our results show a variable influence of deforestation over time, contingent on location of the catchment and amount of original forest cover within the catchment. We lay this foundation in order to address subsequently the potential detriment agricultural expansion has on itself by affecting rainfall rates when converting forested areas to pasture and croplands.

Evidence for accelerated geologic phosphate dissolution in dark-colored drainage lakes and associated wetlands

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Since the establishment of the CWA, Florida water managers have sought to reduce pollutant loads to impaired lakes. While erosion and sediment transport is not typically considered a major NPS pollutant, Florida's geology indicates a closer look. The USGS suggests that geological units containing phosphate are found either at or near land surface across approximately 19% of Florida. As such, erosion and sediment transport in these regions may be a significant source of NPS phosphorus to drainage lakes. While geologic phosphate is often considered stable, stability can vary in an aquatic environment depending on sediment and water chemistry, phosphate material composition, and weathering. In drainage lakes connected to wetlands, unique biogeochemical conditions may create an environment conducive to accelerated geologic phosphate dissolution and increased biologically available phosphorus. Proton-promoted dissolution, ligand-promoted dissolution, aqueous metal-ligand complexation, and microbial acid production occur at various extents within these environments; however, the degree to which these processes influence biologically available phosphorus concentrations *in situ* is unknown. We present here evidence from a case study in the NLW (a setting as described above) that investigated physiochemical indicators of these processes. Techniques used to characterize phosphorus sources and biogeochemical controls and transformations included phosphorus fractionation, core incubation, soil profile analysis and XRD. Results from this study suggest that further investigation into dissolution mechanisms is warranted. The findings from this and further studies may indicate a new approach to managing phosphorus in dark-colored drainage lakes found in regions with phosphate-rich geological units at or near land surface.

List of abbreviations: Clean Water Act (CWA), Newnans Lake Watershed (NLW), non-point source (NPS), United States Geological Survey (USGS), X-ray diffraction (XRD)

The impact of salt water inundation on the stability of freshwater wetland soils

Authors: Kaitlyn Mroccka, Mark Clark, Allan Bacon, Andrew Ogram, Scott Wasman, Todd Z. Osborne

The goal of this research is to investigate effects of salt water transgression events on organic soils from freshwater wetlands at field sites from Cedar Key and the southern Everglades of Florida. It has been observed that salt water intrusion may result in catastrophic loss of organic soils in coastal wetlands currently termed "peat collapse". While current literature invokes accelerated decomposition under brackish to saline conditions, we hypothesize is that salt water may have a dispersive effect on the soil organic matter particles causing a decrease in the soils structural stability. This loss of soil stability then allows for export of soil material during flooding events. To test this we are measuring the change of soil stability under various levels of salt water exposure using a particle size distribution analyzer, bender element and measurements of soil height changes to observe if expansion or compaction is occurring.

Student Compost Cooperative – Making Campus More Sustainable

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Composting is a natural process in which microorganisms break down important available nutrients in various organic wastes including our food scraps, yard waste, animal manure, and garden waste. Once broken down, the recycled product can be used as a nutritious soil amendment in a garden without the use of commercial fertilizers. Composting helps to build organic matter in the soil which retains moisture, prevents diseases, and balances pH levels. Additionally, recycling our organic wastes reduces the amount that accumulates in large landfills which release greenhouse gases that contribute to climate change across the globe. Composting provides the opportunity for our communities to create a more sustainable future by decreasing our dependence on fossil fuels for waste management and fertilizer production. The Student Compost Cooperative (SCC) is a student-led organization established through the UF Soil and Water Sciences Department designed to provide students, faculty, and locals with the ability to compost their own organic wastes at our facility at the Bioenergy and Sustainable Technology Lab and learn the importance of composting. Through social media, the SCC coordinates and holds various educational workshops and hands-on events with the composters. Garden plots are available for those interested in starting to grow their own crops. The SCC aims to encourage and educate students on how they can contribute to making campus a more sustainable community.

Title: Does the Real Refractive Index Matter when Estimating Florida's Soil Particle Size Distribution?

Authors: Pachon, J. C. & Bacon, A.B.

Soil PSD influences nearly all Earth surface processes. While laser diffraction provides rapid, precise, and enriched particle size distribution estimates compared to traditional methods (sieve, pipette, and hydrometer), this analysis assumes the optical parameter RRI of the soil based on mineralogy. The effect of this assumption must therefore be evaluated if laser diffraction is to become a viable tool for characterizing the physical properties of Florida soils. The objective of our work is to quantify the significance of RRI for estimating soil PSD and soil physical properties derived from the PSD. We estimate the PSD of 30 mineral soil samples five Florida soil profiles (an Ultisol, Alfisol, Spodosol, Entisol, and Vertisol) under four RRI assumptions (ranging from 1.5 to 1.6). We find that RRI does not significantly alter our estimate of the complete PSD in all 30 of the soil samples analyzed (Kruskal-Wallis test). Within a given soil profile, we find that RRI explains between 2-45% of the variability in specific surface area, between 2-33% of the variability in clay proportion, less than 6.5 % of the variability in sand proportion; and less than 4% of the variability the mean and median particle diameter. Our findings indicate that RRI within the range tested did not influence the particle size distribution and therefore make a recommendation of using the same RRI for all samples analyzed. We also conclude physical properties may be derived since the greatest RRI influence occurred in clay poor soils with clay estimates intervals of less than ~10%.

RRI= Real Refractive Index

PSD= Particle Size Distribution

SSE= Sum Squared Error

Bottom-up Controls of Recent Harmful Algal Blooms in the northern Indian River Lagoon, FL

Joshua Papacek, Edward Phlips, Margaret Lasi & Patrick Inglett

Ecosystem-disruptive harmful algal blooms (HABs) are becoming increasingly more common in many estuaries. Multiple physical and chemical factors are known to contribute to HABs by increasing phytoplankton growth from the base of the ecosystem. We investigated the major 'bottom-up' factors including temperature, salinity, and available nutrients (nitrogen-N and phosphorus-P) in light of recent algal bloom events since 2011 in the northern Indian River Lagoon (IRL). Of these factors, temperature and salinity have been implicated in other estuaries, but do not show a direct, conclusive correlation with recent HABs in the IRL. In contrast, long-term water quality monitoring data shows a disproportionate increase in total and dissolved P in the water-column since 2010. We hypothesized that increased available P levels, and in turn lower N:P ratios, explain elevated abundance of picocyanobacteria in the IRL and the significant N₂ fixation rates measured leading up to a "brown tide" event. Additionally, uptake experiments suggest that internal recycling of ammonium and dissolved organic forms of N may select for certain species of nano- and pico-planktonic algae that have recently dominated IRL blooms. Secondary effects and feedbacks from these major HABs include declines in seagrass abundance and health, leading to higher internal nutrient loads from senescent biomass, and reduced nutrient uptake and storage by the seagrasses and their epiphytes. This shift in nutrient pools from benthic communities to the water-column likely enhances the turnover of available nutrients via the microbial loop, and could lead to a 'new' ecosystem state favoring widespread and sustained blooms of nano- and picoplanktonic algae.

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 (CO₂ efflux) of shallow and deeper EAA soils exposed to four water management treatments are being evaluated. Additionally, measurements of NO₃-N, NH₄-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 CO₂ efflux rates (between 52 and 157 mg of CO₂ C m⁻² h⁻¹) of all water treatments. The NH₄-N in leachates is highest in flooded soils (0.46 to 0.86 mg L⁻¹) compared to drained soils, whereas NO₃-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 used:

EAA: Everglades Agricultural Area

DOC: dissolved organic carbon

SON: Soluble organic nitrogen

Management intensification effects on soil biogeochemical processes and carbon storage in subtropical grazing lands

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Poster Presenter: Saroop S. Sandhu (Sss67@ufl.edu)

Abstract

A significant amount of native rangeland and woodland have been converted to improved pastures by adopting improved management practices (IMP). These alterations of land use can affect the quantity and quality of soil carbon (C). There is growing interest in understanding the mechanisms and pathways of microbial mediated decomposition of soil organic matter in grasslands as affected by IMP. Most of the previous studies analyzing the effects of IMP in grasslands on soil biogeochemical process have mostly concentrated on the top soil (0-30 cm) which also includes the microbially active soil depths. The sub-surface spodic horizon also stores a large amount of C but not much is known about how the IMP influence the microbial and biogeochemical processes in deeper soils. The objectives of this research were to i) evaluate the effects of IMP on soil biogeochemical processes ii) determine the potential of spodic horizon to store C. The experimental site consisted of two management systems including improved pasture and native rangeland. The IMP consisted of improved grazing, and the addition of inorganic fertilizer and non-woody perennial grass species. The data from this study indicated that IMP resulted in increased soil organic C (SOC) stocks from 31 Mg ha⁻¹ in native rangeland to 63 Mg ha⁻¹ in improved pastures with the majority (10 Mg ha⁻¹ in native rangeland and 24 Mg ha⁻¹ in improved pastures) of C being stored in the spodic horizon. Moreover, improved pastures increased the microbial biomass carbon (MBC) and activity of extracellular enzymes involved in C and N mineralization compared to native rangeland system. The increased activity of beta-glucosidase enzyme was found to be well correlated with the SOC concentration ($r = 0.90$), MBC ($r = 0.79$), TN ratio ($r = 0.96$), and hot water-extractable C ($r = 0.85$) suggesting that the quality and quantity of C substrate play a role in microbial mediated decomposition of soil organic matter. Therefore, improved management practices can be helpful in storing more C in soil along with supporting cattle industry.

Photo-mineralization of Organic Phosphorus and Nitrogen Compounds Present in Vegetation

Tracey Schafer, Todd Osborne, and K.R. Reddy

As UV-intensity increases with climate change, photo-oxidation of organic matter may become a more prominent mineralization method. However, certain compounds are more likely affected by UV breakdown than others. In order to determine which vegetative compounds were more sensitive to photo-degradation, RNA, sodium phosphate monobasic, phytic acid sodium salt hydrate, D-glucose phosphate disodium salt hydrate, atropine, and acetanilide were made into 10 mg L⁻¹ solutions and placed outside in natural sunlight for 3,6, or 9 days in triplicate quartz tubing. A time point zero set of solutions were analyzed for soluble reactive phosphorus, nitrate, and ammonia, along with the solutions collected at the 3,6 and 9 day timepoints. Although still preliminary, results showed phytic acid sodium salt hydrate, a component of seeds and propagules, to be a highly photoreactive compound, whereas other compounds were shown to be more greatly affected by microbial processes.

Authors: Harmanpreet Sidhu, Andrew Ogram, George O'Connor

Microbial response to biosolids-borne ciprofloxacin (CIP) and azithromycin (AZ)

Microbes can be highly sensitive to trace organic compounds (TOCs), but the fate and microbial bioavailability of biosolids-borne TOCs is not well understood. Ciprofloxacin (CIP) and azithromycin (AZ) are two such ionic TOCs commonly present in biosolids, owing to their use to treat a number of bacterial infections in humans. A 90-day microbial incubation study was conducted to assess microbial response to varying environmentally relevant concentrations of biosolids-borne CIP and AZ. We studied changes in microbial respiration and employed molecular techniques (RNA analysis) to study various microbial responses involved in N and P cycles and antibiotic resistance development over time. Using ³H-labeled compounds, we assessed CIP and AZ bioavailability to microorganisms and correlated chemical extractability (potential bioaccessibility) and degradation to microbial responses in biosolids and amended soil media. Positive effects of biosolids amendment outweigh adverse TOC effects from an agronomic viewpoint. However, inhibition of gene expressions of some microbes (at least initially) and expression of antibiotic resistance genes warrant longer term studies to fully assess potential for a biosolids-borne TOC's impacts on microbes and corresponding resistance genes.

Title: Diel Variability in Fish and Invertebrate Community Structure of Big Bend Seagrass Meadows

Authors: Samantha Tiffany, Dr. Laura Reynolds, Whitney Scheffel, Sara Kopetman, Dr. Charles Martin

Abstract:

Seagrasses are productive habitats that support diverse communities of economically and ecologically important fish and macroinvertebrate species. However, the overwhelming majority of assessments documenting faunal and seagrass communities are conducted during daylight hours. In this project, we documented diel variability in fish and macroinvertebrate community structure in seagrass. Additionally, because light pollution affects many coastal areas and may influence day/night community structure, our research also manipulated light levels to determine the impact of nocturnal light on community composition. To answer these questions, we pulled seines along 25-m transects near Seahorse Key, Florida during different diel periods (day or night) and in areas where light was manipulated to mimic light pollution (artificial light or no light). The organisms captured in seines were identified, measured, and counted. Comparisons of total abundance and species richness were made using ANOVAs, and ANOSIM and SIMPER tests were run to test for differences in the community structure between diel periods and artificial light presence, and to identify the species responsible for differences. Results suggest that, while there was no significant difference between total abundance and species richness, community assemblages did change between night and day with *Lagodon rhomboides* (Pinfish) dominating day samples and *Farfantepenaeus duorarum* (pink shrimp) most abundant in night samples. No significant difference was seen with the addition of artificial light. This research highlights the heretofore unrecognized role of diel variability in seagrass communities and suggests that diel movement of organisms may represent an important conduit for the transfer of energy among adjacent habitats.

USING AQUARIUM SALT MIX AS A PROXY FOR SEAWATER IN SEA LEVEL RISE AND CLIMATE CHANGE RESEARCH

Mohsen Tootoonchi, Lyn A Gettys, Kyle L Thayer and Ian J Markovich

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Climate change and sea level rise have the potential to alter the vegetation composition of our aquatic ecosystems. In order to achieve resilience and stability in our ecosystems, we need a better understanding of future changes based on sound scientific projections. Using actual sea water for implementing sea level salinities in laboratory and greenhouse experiments is not always feasible, hence commercial aquarium mixes might be a good substitute to mimic natural saltwater-freshwater systems. In this study, we compared the growth of *Vallisneria americana* (Eel-grass) and *Hydrilla verticillata* (Hydrilla) under 4 salinity levels (0.5, 1.0, 2.5 and 5.0 ppt) induced by 4 different salt types (Sea Water, Instant Ocean Aquarium Mix, NaCl and Morton Sea Salt). Aquatic plants were grown in separate pots filled with Sand or Peat and were submersed in 60 L mesocosms. Salinity levels were increased gradually and water level, salinity and pH were monitored every week. After 10 weeks exposure to increased salinity levels, plants were visually evaluated on a 0-10 scale and destructively harvested to record wet and dry weights. Results and discussion from the biomass harvest, visual evaluation and treatment effects will be presented and discussed in detail at the forum.

BIO: Mohsen Tootoonchi has a Master's degree in Soil and Water Science from the University of Florida. He is working on a PhD in Dr. Lyn Gettys' Aquatic Plant Science Lab at the same institution. His dissertation research examines the effect of saltwater encroachment into freshwater systems.

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The capacity of the saprophytic fungus *Fusarium solani* to affect the population dynamics and insecticidal efficiency of the entomopathogenic nematode *Steinernema diaprepesi*

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Entomopathogenic nematodes (EPNs) are promising biological control agents for insect pests of many crops. *Fusarium solani* as an entomopathogen may compete with EPNs for insect prey, thereby reducing EPN efficacy in the field. Conidia of *F. solani* and infective juveniles of *Steinernema diaprepesi*, alone or in combination, were added to soil microcosms containing sentinel larvae of the weevil *Diaprepes abbreviatus*. Significantly more weevils were killed (83%) in the concomitant species treatment compared to treatments with only the EPN (58%) or the fungus (0%). Fungal conidia increased number of cadavers supporting the nematode reproduction. Moreover, a two-choice olfactometer was used to determine whether *F. solani* recruits EPNs to increase the availability of insect cadavers. *S. diaprepesi* migrated in greater numbers toward the side of tubes containing agar plugs with *F. solani* mycelia and conidia compared to the side with only agar plugs. Our data support the plausibility that *F. solani* increases the effectiveness of *S. diaprepesi* in order to exploit the resources in the cadaver.