Preliminary Analysis for Exploring Nonpoint Source Pollution Indicator Conditions in Coastal Surface Waters of Glynn County, Georgia

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Coastal populations are growing at a significant rate, and the issue of nonpoint source pollution (NPS) has become an immediate concern for environmental professionals. Glynn County, the second largest populated county of the six ocean facing counties of Georgia, is known for its paradise of recreation, along with vital estuaries for marine life. Within this small geographic region, potential threats of NPS from urban sprawl could potentially place surface waters in peril, if these areas are not properly monitored and the proper management decisions are not applied. This preliminary study was designed to assist in protecting coastal waters by gathering and analyzing surface water quality in areas of known onsite wastewater treatment systems (OWTS) densities and stormwater outfalls. The study involved the development of a water quality rubric of standards for evaluation of NPS indicators, with determination of the range and exceedance of various water quality parameters in ten stations of three zones in coastal Glynn County for a one year period. The dataset was analyzed for yearly and seasonal NPS indicator conditions using statistical and spatial perspectives. The study revealed failing water quality standards in enterococcus, chlorophyll-a and dissolved oxygen indicator parameters. These indicators were found by principal component analysis to be influenced by both OWTS and stormwater activity. The protocol and analysis provided in this study was designed to assist federal, state and local environmental health professionals and natural resource planners on critical decisions of land use and best management practices for the control of NPS.

Cleaning-induced arsenic mobilization and chromium oxidation from CCA-wood deck: Potential risk to children

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Abstract: Concern about children's exposure to arsenic (As) from wood treated with chromated-copper-arsenate (CCA) led to its withdrawal from residential use in 2004. However, due to its effectiveness, millions of American homes still have CCA-wood decks on which children play. This study evaluated the effects of three deck-cleaning methods on formation of dislodgeable As and hexavalent chromium (CrVI) on CCA-wood surfaces and in leachate. Initial wipes from CCA-wood wetted with water showed 3–4 times more dislodgeable As than on dry wood. After cleaning with a bleach solution, 9.8–40.3 μg/100 cm2 of CrVI was found on the wood surface, with up to 170 μg/L CrVI in the leachate. Depending on the cleaning method, 699–2473 mg of As would be released into the environment from cleaning a 18.6-m2-deck. Estimated As doses in children aged 1–6 after 1 h of playing on a wet CCA-wood deck were 0.25–0.41 μg/kg. This is the first study to identify increased dislodgeable As on wet CCA-wood and to evaluate dislodgeable CrVI after bleach application. Our data suggest that As and CrVI in 25-year old CCA-wood still show exposure risks for children and potential for soil contamination.

Assessing the potential for phosphorus contamination of ground water in different land uses of the Silver Springs springshed

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Abstract

To assess the environmental risk of phosphorus (P) across different land uses, 11 sites with four types of land use, i.e., urban (5 sites), pasture (4 sites), pine plantation (1 site), and spray field (1 site), were selected within the Silver Springs watershed. Boreholes were drilled in these sites during the period of September and October 2014 allowing the collection of soil, vadose, and aquifer samples at 0.6 m depth intervals. Water extractable PO_4-P, total P, NO_3-N, and NH_4-N, Mehlich 3- P, Al, and Fe, were analyzed on these materials, as well as water quality for the ground water at each site. The P saturation ratio and soil P storage capacity (SPSC, mg kg^{-1}) were calculated for selected depths of all the soil profiles. Significantly positive correlation was found between water extractable P and SPSC when SPSC were negative values (R^2 = 0.41, P < 0.001), indicating a potential of SPSC as a tool to evaluate the environmental risk of P in ground water systems. In general, pine plantations had more positive SPSC values across the whole soil profile, whereas soils with agriculture/pasture land use had more negative SPSC values, suggesting that the land use of agriculture/pasture is more likely to be a source of P leaching to the watershed. For the soils from the urban sites, most showed positive SPSC values in the top 4 m, but dropped to negative SPSC values in some of the deeper clay layers. In contrast, at the spray field site, soils were a potential source of P in the top 3 m (i.e., negative SPSC values) but at depth turned to a P sink (i.e., positive SPSC values). Besides the different land uses, the existence of phosphatic clay layers (Hawthorn formation) likely explains the negative SPSC values in some sites. Water soluble P in the ground water did not exactly follow the patterns of soil extractable P, indicating mixed sources of ground water P. Our results suggest that like other systems, the issue of P storage and mobility will likely be a significant future issue for aquatic systems in this springshed.

Performance of hybrid constructed wetland systems for treating Schoolyard Domestic Wastewater

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The integrated wetland systems were constructed by combining horizontal-flow and vertica1-flow bed, and their purification efficiencies for schoolyard domestic wastewater were detected when the hydraulic retention time (HRT) was ld,3d,5d under different seasons. The results showed that the removal efficiencies of the organics，phosphorus were steady in the hybrid systems. but the removal efficiency of total nitrogen was not steady due to high total nitrogen concentration in the schoolyard domestic wastewater. The average removal rates of COD (chemical oxygen demand)were 89％，87％，83％，and 86％ in summer，autumn，winter and spring，respectively. and it was up to 88％，85％，73％，and 74％ for BOD5(5d biochemical oxygen demand)removal rate in four seasons. The average removal rates of TP (total phosphorous)could reach up to 97％，98％，95％，98％ in four seasons，but the removal rate of TN (total nitrogen) was very low. The results of this study also indicated that the capability of purification was the worst in winter. Cultivating with plants could improve the treated effluent quality from the hybrid system. The results of the operation of the horizontal-flow and vertica1 . Flow cells(hybrid systems)showed that the removal efficiencies of the organics，TP and TN in horizonta1. flow and vertical-flow cells were improved significantly with the extension of HRT under the same season. The removal rate of 3 d HRT was obviously higher than that of l d HRT，and the removal rate of 5 d HRT was better than that of 3 d HRT. but the removal efficiency was not very obvious with the increment of HRT. Therefore,3d HRT might be recommended in the actual operation of the hybrid systems for economic and technical reasons.

Evaluating the Bioethanol Potential of Industrial Sweetpotatoes in Florida

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Sweetpotato (*Ipomoea batatas* L.) is a starch-based crop that can be used for human consumption or biofuel production. The decision on whether to grow sweetpotatoes for food, fuel or manufactured products depends on the needs of the surrounding community. In Florida, an industrial sweetpotato variety (CX-1) is being considered as an alternative crop for citrus lost to greening. The CX-1 was selected for fuel ethanol production because of its large roots with high dry matter (DM) and elevated starch content. A field trial was conducted in Gainesville, Florida to determine the agronomic yields and corresponding starch yields of the CX-1. Rooted versus unrooted sweetpotato vine material was planted in raised beds, with three replications for each material type. Rooted plants were established in trays for 30 days prior to planting while unrooted cuttings were stripped from recently harvested vines and planted directly in the ground. Both plots were harvested 182 days after planting and weighed to determine agronomic yields. Roots were processed into flour immediately following harvest and also after six months of storage and then analyzed for total starch content. The agronomic root yields (DM basis) of the rooted and unrooted CX-1 crop were 3.1 and 1.8 tons/acre, respectively. The starch content of the rooted crop was also higher (71.2% DM) than the unrooted crop (68.5% DM), producing an overall starch yield of 2.2 tons/acre. No significant loss in starch was observed after storage suggesting that this crop could be utilized year-round as a feedstock for ethanol production.

Dominant Drivers of Peatland Soil Organic Matter Chemical Composition

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^{13}C Solid State Nuclear Magnetic Resonance (ssNMR) has become an essential tool for discerning the bulk chemical composition of soil organic matter (SOM). Over 25 years, ^{13}C ssNMR analysis has been used to analyze peatland carbon from across the globe and a range of freshwater peatland communities. However, critical geological regions and peatland types are missing from the database. Furthermore, there has been no synthesis of global peatland SOM chemical composition as determined by ^{13}C ssNMR. We resolved to complete the first meta-analysis of ^{13}C ssNMR data on freshwater peatland soils to understand differences in chemical composition across climate zones, vegetation types, land uses, and nutrient status. Soil samples from the upper 20 cm were collected by the University of Florida Wetland Biogeochemistry Laboratory and global collaborators (numerous samples from the Global Peatland Microbiome Project) and analyzed with ^{13}C ssNMR. Additional ^{13}C ssNMR data of peatland SOM was mined from the literature provided that the study documented peatland type and soil chemical parameters. Canonical correspondence analysis (CCA) revealed patterns in ^{13}C ssNMR functional groups concentrations: carboxyl, aromatic, O-alkyl, methoxyl, and alkyl. The CCA model ($p<0.001$) showed statistical significance between climate zone (0.001), drainage status (0.001), and carbon to nitrogen ratio (0.002) but not pH ($p>0.05$). O-alkyl composition was dominant in the tundra climate, but decreased in abundance for warmer climate zones. Subtropical and tropical samples had higher alkyl, methoxyl, aromatic, and carboxyl functional group concentrations. Forested systems were composed of more alkyl and methoxyl carbon, and extensively drained and farmed sites had the highest aromatic concentrations. O-alkyl contribution decreased as carbon to nitrogen ratio decreased. The meta-analysis highlights important trends and drivers of SOM chemical composition in peatland soils. Contrasting freshwater peatland SOM composition should be considered when considering peatland soil responses to external drivers.

Efficacy of Foliar Nutrient Formulations in Citrus

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Micronutrient deficiencies can significantly depress plant health and production, particularly in commercial crops such as citrus. While root absorption is the primary mechanism of water and nutrient uptake in plants, due to multiple dynamic other influencing factors such as soils, nutrient formulations, etc., uptake of nutrients can be negatively impacted. In such cases, foliar sprays of micronutrients can be more effective than soil applications. At the same time, the chemical formulation(s) of the micronutrient sources can also influence directly the efficacy, absorption and translocation. Two studies were conducted in the greenhouse using 3-month old citrus (var. Hamlin *kuharske*) as the test, plant, where 3 different foliar formulations each of zinc and copper were compared against a control, replicated six times. Zinc formulations included sulfate, nitrate, a potassium based solutions and copper formulations included sulfate, nitrate and hydroxide solutions. Leaf samples were collected at 0.5, 1, 2 and 3 days for zinc study and 0.5 and 1 day for copper study and analyzed for Zn and Cu on the ICP-OES (Mylavarapu et al, 2014). Data were statistically analyzed and the means were separated using Tukey test. Time after foliar application was not significant. Both Zn and Cu showed highest leaf tissue concentrations for the nitrate based formulations compared to sulfate. The traditional sulfate based solutions also are absorbed however in significantly lower concentrations. Injury to the leaves should be avoided due to the high absorption rate when using nitrate based solutions. Nitrate based formulation of certain micronutrients may be an effective alternate for increased foliar absorption and for market economics.

Keywords: Zinc; Copper, Citrus Hamlin *Kuharske*; leaf mineral contents;

Pharmaceuticals and Organochlorine Pesticides in Sediments of an Urban River in Florida

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Bed sediments (0-10 cm) from a rural to urban gradient along the Alafia River in Florida, United States were collected to determine the risk of environmental contamination with legacy (organochlorine pesticides, OCPs) and new contaminants (pharmaceuticals). Three most frequently detected pharmaceuticals in sediments were carbamazepine (100% of samples), trimethoprim (89% of samples), and pseudoephedrine (63% of samples). While acetaminophen, diphenhydramine, lidocaine, and nicotine were detected in <30% of samples. The detection of caffeine in all sediment samples suggests that domestic wastewater from wastewater treatment plants and/or septic systems may be a contributing source at all the sites. Among the OCPs, endosulfan I was most frequently detected (37% of samples), followed by δ- hexachlorocyclohexane (15% of samples), γ-chlordane and endosulfan II (both in 11% of samples), and dichlorodiphenyldichloroethylene and methoxychlor (both in 7% of samples). The lower concentrations of OCPs (sum: 0-16.1 ng g^{-1}) than pharmaceuticals (sum: 0.5-61.9 ng g^{-1}) in sediments are probably due to the historic use of OCPs since these were banned for use in the United States in 1970s, while pharmaceuticals are still used. The variability in detection and concentrations of legacy and new compounds in rural and urban stream sediments is likely due to the different magnitude of input sources, site characteristics, and chemical properties of individual compounds. Significant positive correlations between OCPs and sediment properties (organic matter, silt, and clay) suggest that sediments are a major sink of various contaminants in the Alafia River. We conclude that the concentrations of both pharmaceuticals and OCPs in sediments of urban river are relatively lower than existing literature; however, these can still be of environmental concern to aquatic organisms.