Title: Impacts of management intensification on soil carbon stocks in subtropical grasslands.

Authors: Julius B. Adewopo[1†], Sutie Xu[1], Maria L. Silveira[1,*], Stefan Gerber[2], Lynn Sollenberger[3], Tim Martin[4].

Affiliation: [1]University of Florida, Range Cattle Research and Education Center, 3401 Experiment Station, Ona, FL, USA, 33865. [2]University of Florida, Soil and Water Science Department, 2185 McCarty Hall A, Gainesville, FL, USA. 32611. [3]University of Florida, Agronomy Department, Gainesville Fl, USA. 32611-0500 [4]University of Florida, School of Forest Resources and Conservation, 359 Newins-Ziegler Hall, Gainesville, FL, USA. 32611-0410.

† Presenting Author

Soil acts as sink and source of atmospheric carbon (C). Assessment of the long-term impacts of land-use change on soil C stocks is crucial for the sustainability of managed grasslands and for climate change mitigation. This study was conducted to assess the long-term (> 20 yr) impacts of grassland intensification on above- and below-ground C stocks in subtropical ecosystems. The experimental sites consisted of three replicated grassland ecosystems: native-rangeland (least-managed), slash-pine-bahiagrass silvopasture (moderately-managed), and improved bahiagrass pasture (intensively-managed). Soil cores (0-30cm depth) were collected within six adjacent experimental fields (3 ecological units × 2 replicates) to assess C stocks. Root and above-ground biomass were also quantified. Grassland intensification increased soil C stocks. Improved pasture and silvopasture contained greater soil C (62 and 69 Mg/ha, respectively) than the native rangeland (41 Mg/ha). Root biomass C in native rangeland and improved pasture (24 and 19 Mg/ha, respectively) was comparable, but lower in silvopasture (15 Mg/ha). However, above-ground biomass C was greater in silvopasture compared to native rangeland (59 vs. 4.2 Mg/ha), but lower in improved pasture (2.1 Mg/ha). Particulate organic C was greater in improved pasture compared to native rangeland (34 vs. 21 Mg/ha, respectively) but did not differ from silvopasture (27 Mg/ha). Silvopastures exhibited greater amounts of stable mineral-associated C (42 Mg/ha) compared to native rangeland (20 Mg/ha) or improved pasture (28 Mg/ha). Our findings indicate that intensification of grasslands can increase soil C sequestration in the long-term, and can provide additional benefit in above-ground biomass C sequestration.

Response of Carbon and Metals to Experimentally-Controlled Water Tables

C. Banik, W.G. Harris, A.V. Ogram, V.D. Nair, and M.J. Cohen

Abstract:

Seasonal water tables are common in sandy coastal plain soils of the SE USA but their role in soil organic carbon dynamics is uncertain. Seasonal saturation influences biogeochemical processes that affect fate of organic matter and metals. A column study was conducted to test hypotheses that shallow water table (SWT) conditions reduce CO_2 loss to the atmosphere (H1), increase leaching of dissolved organic C (DOC) and metals (Al and Fe) (H2), and result in greater net C storage in the soil (H3). The A and E horizons from 5 Ultisols were sampled. Ten 90-cm columns (2 per soil) were packed with A-horizon (20 cm) over E-horizon material (60-cm). Five columns, one from each soil, were subjected to SWT treatments and 5 to deep water table (DWT) treatments. Upward CO_2 flux was measured using a 1 M NaOH trap. Metal and DOC concentrations in leachates and in water sampled at the surface of columns were measured by ICP-OES and C analyzer, respectively, and degree of aromaticity (E_4/E_6 ratio) was measured by UV-vis spectrophotometer. A significant decrease in upward CO_2 release occurred for SWT (supporting H1). Higher DOC (for all events) and Fe concentrations (for first 18 days) were measured in SWT leachates (supporting H2). Carbon and metal concentrations of surface solutions and E4/E6 ratios were higher under SWT than DWT. Net loss of C was less under SWT (supporting H3). Results indicate significant water-table effects on magnitude and direction of C flux (solution or gaseous) for coastal plain soils.

Title: Socio-economic Valuation of Ecosystem Services in the Suwannee River Basin.

Authors: P. Chaikaew, A.W. Hodges, S. Grunwald

Abstract

Humans are an integral part of the ecosystem, by contributing to its functions and structure, while at the same time imposing needs on the ecosystem. In order to protect and conserve functioning ecosystems it is necessary to understand how humans perceive and value ecosystem services. The objectives of this study were to investigate the perceptions of households in the Suwannee River Basin of Florida and assess their willingness to pay to protect these ecosystem services. A mail survey of 4000 households in north-central Florida was implemented using the Tailored Design Method, with valid responses received from 764 households (19% response rate). Respondent perceptions regarding ecosystem services were analyzed using different attitude scales and preferences were assessed using a conjoint choice experiment. A conditional logit model was used to evaluate marginal willingness to pay to conserve three types of ecosystem services under different scenarios for program administration and location to be managed. Findings suggest that respondents were most concerned about poor water quality, and nutrient control was the most preferred ecosystem service type to be managed, followed by agricultural productivity, and climate/carbon regulation. Respondents favoured having county government as the agency to manage ecosystem resources, rather than the Suwannee River Water Management District or non-government organizations. Respondents expressed a strong preference for ecosystem protection programs to be implemented anywhere within the river basin rather than to closer to their homes. These results may enable estimation of the non-monetary economic value of ecosystem services to people residing in the Suwannee River basin.

Presentation type: Oral

Land Use Effects on Nitrous Oxide Production and Consumption in Subtropical Peatlands.

Jing Hu*, Kanika S. Inglett, Alan L. Wright, K. Ramesh Reddy
Wetland Biogeochemistry Laboratory, Soil and Water Science Department, University of Florida, USA

Peatlands are a potential source of nitrous oxide (N_2O) to the atmosphere, and have significant impacts on global climate change. Large areas of peatlands in south Florida have been converted into agricultural lands, currently known as the Everglades Agricultural Area (EAA). Objectives of this study were to: (1) determine N_2O production (N_2O_{pro}) and consumption (N_2O_{con}) potentials in soils under different land uses; (2) examine the limiting factors of N_2O cycling; and (3) investigate the effects of soil biogeochemical properties on N_2O_{pro} and N_2O_{con}.

A batch incubation study was conducted on soils (0-10 cm) collected from four land uses in the EAA, Florida: sugarcane, vegetables, turfgrass, and uncultivated soils. During a 116-h incubation, total N_2O_{pro} was significantly higher in turfgrass (85.4 ± 13.9 mg kg^{-1}) and uncultivated (68.3 ± 3.4 mg kg^{-1}) soils, compared to that in sugarcane (20.3 ± 5.1 mg kg^{-1}) and vegetable (29.9 ± 0.9 mg kg^{-1}) soils, which were the most intensively cultivated and managed land uses. Turfgrass soils had the highest N_2O_{con} (72.3 ± 10.3 mg kg^{-1}), which was 2 times higher than uncultivated soils, and about 3-fold greater than sugarcane and vegetable soils. In terms of net N_2O production, $N_2O_{net} = N_2O_{pro} - N_2O_{con}$, the lowest was observed in sugarcane soils (1.4 ± 0.3 mg kg^{-1}) and the highest in uncultivated soils (31.5 ± 3.4 mg kg^{-1}). Nitrous oxide production and consumption were limited by NO_3^- in sugarcane soils while by labile organic C in other land uses of those peatlands studied.

Employing a Nitrogen Budget and Crop Model SUBSTOR to Track Nitrogen Losses from Potato Production in Sandy Soil.

Rishi Prasad and George Hochmuth

Soil and Water Science Department, University of Florida, Gainesville, FL

Nitrogen loss from agricultural system is associated with elevated concentrations of nitrate-N in surface and ground water leading to impairment of water bodies. A water body is impaired when the water quality criteria are not met and the designated use of water body is compromised. Management of agricultural N is critical, especially in sandy soils which have low water and nutrient holding capacities. Farmers have been encouraged to adopt best management practices (BMP) to reduce potential N losses from agricultural system but there is little research information on quantifying the sources and sinks of N for these BMPs. Quantification of inputs and outputs for a production system will give a better insight on the most important pathways leading to N losses to the environment and to solutions to reverse N loss. The objective of this study was to construct a budget to quantify the sources and sinks of N for a potato production system on a diversified farm in northern Florida with sandy soils and center-pivot irrigation for a period of three years. Nitrogen budgets were prepared by quantifying the inputs and outputs of N associated with the potato production systems. Crop model SUBSTOR within DSSAT was also employed to study the N balance over three years. Upon validation of the model using the data derived from three years of field study, risk analysis was conducted by simulating crop management scenarios through time and space. The budgets indicated average N recoveries of 67%, 45%, and 59% of total available N in potato for years 2010, 2011, and 2012 respectively. The average unaccounted-for N losses were 88, 157 and 105 kg ha^{-1} N for potato production in years 2010, 2011, and 2012 respectively. N loss was comprised of gaseous N losses.