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# Soil and Water Science Department Seminar

**Speaker:** **Hamza Keskin**
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**Advisor:** Dr. Sabine Grunwald

**Title**: **Digital Mapping of Soil Carbon Fractions**

**Date:** Monday, October 19th

**Time:** 3:00 pm

**Location:** McCarty Hall B, Room G086

The lability/stability of soil carbon (C) is profoundly important and linked to the amount of C stored in soils, but upscaling of site-specific soil C pools to coarser landscape scale is rarely found in the literature. Our understanding of the spatial distribution of soil C pools across diverse land uses, soils, and climatic gradients at regional scale is still limited. Research in digital soil mapping and modeling that investigates the interplay between (i) soil C pools and environmental factors ("deterministic trend model") and (ii) stochastic, spatially dependent variations in soil C fractions ("stochastic model") is just emerging. This evoked our motivation to investigate soil C pools in the State of Florida covering about 150,000 $km^2$. Our specific objectives were to (i) compare different soil C pool models that quantify stochastic and/or deterministic components, (ii) assess the prediction performance of soil C models, and (iii) identify environmental factors that impart most control on labile and recalcistrant pools and total soil C (TC) in Florida. We used soil data (0-20 cm) collected at 1,014 georeferenced sites including measured bulk density (BD), recalcitrant carbon (RC), labile (hot-water extractable) carbon (HC) and TC. A comprehensive set of 327 geospatial soil-environmental variables was aquired within a Geographic Information System to allow spatial extractions to pedon locations. The Boruta method was employed to identify "all-relevant" soil-environmental predictor variables and the most parsimonious model for soil RC, HC and TC. We employed eight methods - Classification and Regression Tree (CaRT), Bagged Regression Tree (BaRT), Boosted Regression Tree (BoRT), Random Forest (RF), Support Vector Machine (SVM), Partial Least Square Regression (PLSR), Regression Kriging (RK), and Ordinary Kriging (OK) – to predict soil C fractions and TC. The fit and accuracy of each method was assessed from 304 randomly chosen samples of the whole set (validation). Overall, 36, 20 and 25 predictor variables stood out as "all-relevant" to estimate TC, RC and HC, respectively. We predicted a

mean of 5.39 kg TC $m^{-2}$ with standard error of 3.74 kg $m^{-2}$ in the top 20 cm of Florida's soil. The RC contributed about 60% of the TC stocks, whereas HC was less than 5% of TC stocks. The prediction performance based on the accuracy assessed by the Ratio of Prediction Error to Inter-quartile Range for TC stocks was as follows: : RF > SVM > BoRT > BaRT > PLSR > RK > CART > OK. The best models explained 71.6%, 71.7% and 30.5% of the total variation for TC, RC and HC, respectively. Biotic and hydro-pedological factors explained most of the variation in soil C pools and TC, lithologic and climatic factors showed some relationships to soil C pools and TC, whereas topographic factors faded from soil C models. The identified relationships allowed to build soil C prediction grids that serve as a resource to support soil, water and environmental security in the State of Florida.

For our off-campus students, off-campus faculty, and on-campus students who cannot attend, all seminars can be viewed at: http://mbreeze.ifas.ufl.edu/seminars. In addition, all seminars are archived for viewing at http://soils.ifas.ufl.edu/academics/seminars.shtml