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Soil and Water Sciences Department
Graduate Student Exit Seminar

Speaker: **Wade Ross**
Ph.D. Degree Candidate

Advisor: Dr. Sabine Grunwald

Title: **A Region-Wide Analysis of Terrestrial Carbon Cycling Across 'The Land of Pines'**

Date: Monday, March 20, 2017

Time: 3:00 pm – 4:00 pm

Location: McCarty Hall A, Room G186

Climate projections indicate that the Southern US will become warmer and potentially drier by the end of the 21st century. This is an important consideration for land managers as the region is home to some of the most productive and valuable timberlands in the world. Furthermore, these ecosystems mitigate a substantial fraction of anthropogenic emissions via carbon sequestration and contain a considerable amount of carbon in biomass and soil. Forest and soil carbon sequestration is predominantly a function of productivity and regional climate conditions; however, much of our knowledge regarding terrestrial carbon cycling in response to climate projections has been derived from global scale studies, which are too coarse to provide adequate guidance at local and regional scales. Thus, the overarching objectives of this analysis were twofold: 1) quantify current terrestrial carbon stocks across the Southern US and 2) assess the response of forest productivity and carbon cycling to climate perturbations. We used a combination of mechanistic and machine learning methods to achieve these objectives. Stand-level biomass estimates and soil carbon measurements to 1m depth were collected from 326 research sites strategically positioned to capture the variation of climate and soils that characterize the region. Analysis of field data indicated that the largest fraction of terrestrial carbon was attributed to soil (53%), followed by stemwood (28%), coarse root (8%), branch (5%), stembark (4%), and foliage (2%). Terrestrial carbon stocks were modeled by applying data mining techniques to a large suite of spatially explicit environmental data (~ 7 TB) to identify important regional-scale predictors for Random Forest models. The best models achieved an adjusted R^2 of 0.96 and 0.62 with model training and validation datasets, respectively. Forest productivity and carbon cycling in response to climate perturbations was assessed with a climate-driven experiment using the DayCent model. Regionally downscaled representative concentration pathways (RCP 4.5 and 8.5) were used to represent a range of potential climate scenarios. DayCent simulations covering the measurement period (2012 to 2014) were validated with field-based data and indicated robust agreement across the region, with mean absolute percentage error ranging from 6% for soil organic carbon to 51% for belowground net primary productivity. DayCent forecasts to the end of the 21st century demonstrate that forest productivity is clearly sensitive to climate perturbations. Our findings suggest that the terrestrial carbon sink capacity of pine forests will increase under a broad range of potential climate scenarios.

For our off-campus students, off-campus faculty, and on-campus students who cannot attend, this seminar can be viewed via live or watched at a later date via this link: Wade Ross. In addition, all seminars are archived for viewing on our SWSD Seminar Page.